DOCUMENT RESUME

ED 104 641 SE 018 121

AUTHOR	Presnell, Richard W.
TITLE	Environmental Education - A Problem Approach. Final Report.
INSTITUTION	Wisconsin Univ., Green Bay.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C. Office of Environmental Education.
PUB DATE	Oct 73
GRANT	OEG-0-72-4995 (Revision #1)
NOTE	100p.; Best Copy Available; Occasional Light Print
EDRS PRICE	MF-$0.76 HC Not Available from EDRS..PLUS POSTAGE
DESCRIPTORS	*Adult Education; *Community Education; Community Involvement; *Environmental Education; Learning Activities; *Problem Solving; Science Education
IDENTIFIERS	*Wisconsin

ABSTRACT

The envrionmental education project, "A Problem Approach," was designed to involve University faculty and community leaders in a number of goals. They attempted to produce a series of audio-taped slide presentations designed to develop a working level of environmental literacy in the project participants and in those people who subsequently utilize the materials in community group meetings and classrooms. Emphasized in each presentation was the importance of citizens in examining alternative solutions to environmental problems, as well as their responsibility to be concerned with environmental problems and to work cooperatively toward developing rational solutions to current and future problems. The topics defined for use were Air Quality; Communication, Noise, and Life Quality; Ecological Concepts; Energy; Solid Waste Management; Transportation and Land Use; and Water Quality. Most of the goals were achieved with varying degrees of success, though four of the slide presentations were never completed. (Author/MA)

ED104641

Final Report

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Grant No. OEG-0-72-4995 (Revision #1)

Environmental Education - A Problem Approach

Dr. Richard W. Presnell
Faculty in Education
The University of Wisconsin-Green Bay
Green Bay, Wisconsin 54302

October 1973

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education

Office of Environmental Education

SE 018 121

Final Report

Grant No. OEG-0-72-4995 (Revision #1)

Environmental Education - A Problem Approach

Dr. Richard W. Fresnell

The University of Wisconsin-Green Bay

Green Bay, Wisconsin

October 30, 1973

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U.S. DEPARTMENT OF

HEALTH, EDUCATION, AND WELFARE

Office of Education

Office of Environmental Education

CONTENTS

Page

Project Overview..... 1

Objectives..... 2

Design and Processes..... 4

Resources..... 6

Coordination..... 6

Evaluation..... 7

Financial Summary..... 9

Appendix (Project Material Products)

A. Presentation Outlines and/or Scripts.....10

B. Presentation Slide Lists.....72

C. Presentation Supplementary Materials

Leaders Directions.....81

Discussion Question Lists.....86

Accompanying Literature.....93

Reading Lists.....94

PROJECT OVERVIEW

The environmental education project, "A Problem Approach," attempted to produce a series of audio-taped slide presentations designed to develop a working level of environmental literacy in the project participants and in those people who subsequently utilize the materials in community group meetings and classrooms. The primary message of each presentation is that citizens not only can play important roles in examining alternative solutions to environmental problems, but that people have a responsibility to be concerned with environmental problems and work cooperatively toward developing rational solutions to current and future problems. A major assumption of the project was that the most effective route to comprehension of environmental concepts, environmental literacy, and to constructive action in citing environmental problems, was through careful study of environmental problems.

The environmental problem areas defined for the seven audio-tape slide presentations include Air Quality: Communication, Noise, and Life Quality; Ecological Concepts; Energy; Solid Waste Management: Transportation and Land Use; and Water Quality. The presentations were to have been developed by a number of University of Wisconsin-Green Bay faculty and staff in cooperation with members of eight area community agencies and organizations. The content of the seven 25-minute presentations was to have been patterned after similar, but substantially longer, environmental problem programs presented by University of Wisconsin-Green Bay personnel during a series of environmental education workshops with staff of the Milwaukee Public Schools during the summers of 1971 and 1972. The specific contents and communication approach of the project presentation scripts and the subjects of the supplementary slides was to have been designed and produced by the authors of the original presentations and representative members of the eight community groups under the guidance of the Project Director and with the assistance of University communications technology staff. The materials development process was expected to follow a pattern of script writing and slide selection, testing of materials, feedback and revision, and retesting of altered materials until such time as both University and community participants agreed upon the educational effectiveness of each of the presentations. Another project product, a Project Process Manual was to have been developed by a process of cooperative evaluative feedback, similar to the audio-tape slide presentations development process. Frequent personal contact between University and community project participants was to have facilitated project materials development and evaluation. A long-range goal of this project was the replication and dissemination of the project materials both within Northeastern Wisconsin and to interested individuals and groups throughout the country.

BEST COPY AVAILABLE

OBJECTIVES

The primary goal of this project was the development of educational materials and processes that would motivate an interested adult citizenry to (1) become more fully informed of the facts of various environmental problems, and (2) define for themselves and assume environmental action roles that would promote durable solutions to those environmental problems. Other objectives of this project might best be described as process objectives. It was the intention of the project proposal authors that effective processes of university-community cooperation in educational materials development be defined, that these processes be elucidated in a project process manual, and that later they be made available to other interested individuals and groups.

The project goals were established by Dr. Richard W. Presnell, Dr. George T. O'Hearn, and Dr. Robert S. Cook, authors and/or advisors of the project proposal. The goals were derived in part from needs defined during a summer environmental education workshop with members of the staff and faculty of the Milwaukee, Wisconsin Public School District, from communications with leaders of a variety of local organizations and agencies, from the educational philosophies of the U.S. Office of Environmental Education, and from the environmental action philosophy expressed in the Environmental Protection Agency booklet, Don't Leave It All to the Experts - A Citizen's Guide to Environmental Decision Making. The operational goals and specific environmental problem presentations' content emphases reflect areas of expertise of various University of Wisconsin-Green Bay faculty members and the Project Director's past experience with development of audio-tape teaching/learning materials.

It is the opinion of the Project Director that the general goals were and remain valid goals in this and other environmental education efforts, but that specific operational process objectives of the project were too comprehensive and were poorly defined. Assumptions by the project proposal authors as to the degree of interest in the specific environmental problem areas and the amounts of time available for participation in materials development by both University and community people proved to be poor assumptions. Too few University faculty and staff participants were actively involved in the development of the project, and therefore had too little equity in either the goals or the processes of this project. The results of this weakness will be described in more detail in latter sections of this report. The project goals may have been somewhat inappropriate for some community participants for much the same reason. Although the leaders of the various community groups were consulted in the development of the project proposal, the members of these organizations (the people who were to assume a high degree of participation) were not so involved.

Selective participation in proposal development resulted in both University and community leaders committing others to a degree of

participation that, for various reasons, they were unable to fulfill. Some community leaders misunderstood the roles required of them and of their members, and other community leaders assumed that their endorsement of the project, rather than their participation, was requested. I suggest that readers be reminded, as is the author, that in planning future projects all participants' participation roles should be clearly defined and all participating individuals be required to commit themselves to specific roles before project proposals are written and operations commenced. The communications and contractual agreements resulting from such a procedure should greatly enhance the satisfying of the goals of any project.

As stated in the project proposal, "The major objectives of the environmental education project is to develop a working level of environmental literacy in people who participate in the project and of those who subsequently utilize the environmental education materials in community meetings and classrooms." The author believes that this objective was met for most of the people (approximately 140) who participated in the development and use of one or more of the three completed environmental education presentations, and in preliminary development of the remaining four presentations. Most of these participants were, however, reasonably concerned with environmental problems prior to being involved in the development of the project materials. This prior concern of participants enhanced materials development but resulted in the all too common situation of committed and concerned people talking with people having similar ideas, commitments, and concerns. The author would like to have had people with less concern and commitment involved in the early development of the materials. Another project failure, in the opinion of the Project Director, is reflected in the failure to complete the final audio scripts for four presentations: (1) Air Quality; (2) Communications, Noise and Life Quality; (3) Transportation and Land Use; and (4) Water Quality. This resulted in part from insufficient concern of participants in these topics. The general notion of some participating individuals and groups, that they were relatively powerless in affecting solutions to those problems, greatly contributed to the reduced interest in those topics. Other individuals felt that sufficient progress toward solving problems within the scope of the four topics had already been accomplished by legislation. And others suggested that the topics themselves were to some degree unrealistic--that some of the four topics were in fact symptoms of more basic environmental problems--the basic issues in air and water quality, for example, being man's historic mismanagement of not only these but all natural resources.

The major project objective of "increasing sensitivity of the participants to each other in and among their groups" met with partial success. Most of the active participants were already aware of the views and interests of others prior to the project. Those University and community people who assumed roles in this project had a history of such activity in a variety of other communiversity activities. In the

author's opinion, too few noninvolved people became involved in this project. This situation probably reflects the fact that most people remain apathetic to environmental issues until such time as the issues attain 'crisis' proportions to them. The fact that most not-normally involved participants played roles in developing only the Energy presentation and the Solid Waste presentation (solid waste management being a widely publicized local problem) suggests this. Future use of the completed educational presentations and, upon completion, use of the other four presentations will hopefully attract and involve audiences who have been relatively inactive in environmental decision making--people toward whom the project was originally designed and directed.

The final project objective, that "participation would result in identification of additional target audiences in the community and the region," was accomplished. A variety of local and regional groups were suggested as potential users of the environmental education materials of the project. The kinds of people who are willing to devote time and effort to a project such as this are generally people who are involved in a wide variety of community activities. Their contacts with community groups can provide information as to other potential users of educational materials.

DESIGN AND PROCESSES

The reason for selecting the educational strategies employed were to a large degree based on logistical difficulties in bringing information and materials to community groups. It was believed by the project proposal authors that a communication network of University people and leaders of selected community organizations would facilitate communication to a wide variety of participants in target audiences. It was also felt that the audio tape slide presentation format would provide an easy, inexpensive mechanism by which community organizations could be made aware of concepts and trends in a variety of environmental problem areas. The Brown County area, much like primarily urban and suburban regions across the country, has experienced its share of a variety of environmental problems. This particular area has had a history of water problems in the Fox River. In recent times it has experienced difficulties in solid waste management and in air quality. There is also a growing awareness of land use and transportation problems. The public has possibly a greater than average firsthand awareness of some environmental problems. The University of Wisconsin-Green Bay is located in the area, and having a special mission in environmental concern and in problem solving, contributes to making this community somewhat unique. I suggest that the community is also somewhat unique in the amounts of frustration experienced by many environmentally aware and active citizens. Most community members can be characterized as people who, by habit, have relied on "experts" to dictate their behaviors in environmental and other matters in the past. Too many community people who have made

efforts to influence decisions that affect environmental quality have become frustrated in their efforts, because of a general feeling that environmental matters are best left to governmental and other experts. Some exceptions to these types of behaviors are to be found in some of the groups selected as community participating organizations for this project. Some of these groups have had for varying periods of time some success in influencing decisions affecting the environments of Northeastern Wisconsin.

The operational design of this project called for frequent communication between and among University and community participants, communication mostly directed at developing audio tape scripts, perusing preliminary audio scripts and suggested exemplary colored slides and supplementary reading materials for the different presentations. This operational design assumed a commitment by the designated participants to expend the necessary time and energy to complete these tasks. Some, not enough in the author's opinion, community participants carried through their commitment. An even smaller proportion of University personnel, designated as participants, carried through their commitment. The reasons for less than desirable involvement by community people have been discussed earlier. Some reasons involve incomplete understanding of participation roles. Others center on attitudes of members of the community groups--frustrations from some past failures to influence environmental decision making and habits of leaving decisions, both educational and others, to the experts. In this instance, University professors were viewed as the "experts." A few participating organizations and members representing some organizations seemed to feel that they were incapable of contributing valid criticism to the format and content of the environmental problems presentation.

Frequent failure of University personnel to participate in this project is to a large degree due to the fallacy of both project development and program design. Fallacy of program design is exemplified by the assumption in the proposal that University of Wisconsin-Green Bay original environmental problem script writers would feel an obligation to edit the transcripts of their earlier presentations. Three of twelve University people made some effort to edit their original scripts. The remaining University personnel declined to edit their scripts and in most cases declined to respond to the request to play this or other roles described in the proposal. These failures of commitment to the project resulted in placing most of the responsibility for initial script development, perusal of the literature for script revision and other technical responsibilities on the Project Director. Although the lack of commitment to the project by University personnel is due primarily to inadequacies in early project design, it is also due in part to a work overload on most of the University personnel designated as participants. The University is a young, growing, evolving institution, requiring very large expenditures of time and effort of its staff and faculty. Most University faculty are involved in numerous environmental education efforts. This environmental education project

BEST COPY AVAILABLE

was but one of many such efforts involving UWGB faculty. This project was not a high priority educational effort for any of the University faculty and staff other than the Project Director.

RESOURCES

With the exception of community participants representing members and/or staff personnel from most of the cooperating community organizations, the project staff consisted of the project director (one third University assignment time for nine months and full-time for two months) and one part-time secretary. As discussed earlier and described in the project proposal, 15 University of Wisconsin faculty were to have assumed various roles in editing, consulting, and evaluating the project. Three of these people offered some editing time and two provided some consultation. This lack of cooperation by University faculty was not anticipated in the original planning. A number of community people from the League of Women Voters of the Greater Green Bay Area, Project I.C.E., an E.S.E.A. Title III environmental education project, and Concerned Households provided editing and consultant assistance during the development of some portions of the project materials.

It is the author's opinion that financial needs were generally met, but that additional money for consultant fees would have provided consultant time for editing of the original project presentation scripts. I recommend that for future environmental education projects of a similar design, consultant monies be made available, even if small in amount, to all participants.

A portion of the necessary project materials and facilities designated in the proposal were made available by the University of Wisconsin-Green Bay. Three cassette player-recorders, one color slide projector, two floodlight reflectors, facilities for print materials duplication and conference rooms were provided. The Director provided his personal camera, slide duplicator, drawing boards, copy stand, and other necessary equipment, as well as photography studio facilities and storage space for most material resources. The Project Director also provided most of the print reference books and materials from his library, and acted as the script author, editor, photographer, and audio script recorder for all phases of project presentations development. Some material resource suggestions were provided by the staff of Project I.C.E. and some technical advice was provided by a member of the UWGB staff.

COORDINATION

A number of environmentally concerned organizations and/or committees exist in the Green Bay area. Those believed to be the most active were designated as co-sponsoring agencies in the project proposal. As stated earlier, some of these groups played minor or no roles in this project.

It is the author's opinion that these groups generally believed their role to be primarily endorsement roles rather than participatory roles.

During the project period, the Director had frequent communication with Project I.C.E. staff, the chairperson and selected members of the Environmental Quality Committee of the League of Women Voters, members of the Brown County Conservation Alliance, the president of Women for Environmental Balance, and some members of Concerned Households. Area groups, not included in the original plans but active in presentation evaluation, include the local chapter of the National Audubon Society and Concerned Households, a group active in local recycling efforts and in solid waste management planning.

The leaders and members of these six organizations made valuable contributions to the successes of the project. Their cooperation was due primarily to their concern for future human life quality. Their continued interest in the project was, in the author's opinion, due mostly to the relatively high frequency of personal communication between representatives of the groups and the author at public hearings and organizational meetings on a variety of local environmental problems. A common bond of assistance and support, which existed to some degree prior to this project, was developed and/or reinforced during project meetings and other private and public meetings. The author, acting as a delegate to the Brown County Conservation Alliance from the local chapter of Trout Unlimited, found that attendance and active involvement in their monthly meetings enhanced cooperative efforts between the project and this group. I suggest that such personal contacts and commitments are necessary to the success of any cooperative venture.

EVALUATION

No formal evaluative tools specific to this project were developed. People who participated in presentation evaluation were asked to respond in writing to a variety of questions centering on such topics as the clarity and appropriateness of visual materials and script, the psychological tone of the presentation, the time duration, and ease of handling the slides, tapes, and presentation hardware. Post presentation discusion revealed a wide variance in participants' background information, but it was found that, in general, those community individuals who perused the presentations were reasonably knowledgeable and greatly concerned about the presentation topics. Discussions during prescribed presentation "break" times and discussionsfollowing presentations provided opportunities for participants to ask and answer questions related to local environmental concerns. These exchanges of ideas and concerns precipated environmental action efforts by some participants; demonstrated primarily by their new or continued attendance and activity in local public hearings on various environmental issues.

The author intends to continue project presentation development and piloting on his own time and expense. If community organization evaluative feedback indicates reason to promote wider use of the project presentations the author will solicite funding for further refinement of materials and dissemination, as suggested on page 13 of the project proposal.

Department of Health, Education, and Welfare

Grant No OEC-0-72-4995

NAME AND ADDRESS OF GRANTEE INSTITUTION

University of Wisconsin-Green Bay
Green Bay, Wisconsin 54302

TRANSACTION NO

INSTITUTIONAL ID NO

DATE OF THIS REPORTING PERIOD
FROM 01/15/73 TO 09/30/73

PROJECT PERIOD
FROM 06/20/72 TO 09/30/73

XX CHECK IF FINAL REPORT

1. Expenditures of DHEW Funds for this Report Period

a. Personnel	$ 8,398.33	h. Alterations and renovations	
b. Consultant services	-----	i. Other	
c. Equipment	-----		
d. Supplies	509.35	j. Total direct costs	8,907.68
e. Travel, domestic	-----	k. Indirect costs: Rate 8 % ☐ S&W XX TDC	
f. Travel, foreign	-----	Base $ 8,907.68	712.58
g. Patient care cos	-----	l. TOTAL	$ 9,620.26

2. Expenditures from Prior Periods (previously reported)	-----
3. Cumulative Expenditures	-----
4. Total Amount Awarded - Cumulatively	10,000.00
5. Unexpended Balance (Item 4 less Item 3)	379.74
6. Unliquidated Obligations	384.74
7. Unobligated Balance (Item 5 less Item 6)	5.00
8.a. Cost Sharing Information - Grantee Contribution This Period	
b. % of Total Project Costs (Item 8a divided by total of Items 1 and 8a)	%
9.a. Interest/Income (enclose check)	
b. Other Refundable Income (enclose check)	

10. Remarks

A detailed financial report will be submitted by University of Wisconsin-Madison Finance office.

REPORT OF RESEARCH GRANT EXPENDITURES

BEST COPY AVAILABLE

BEST COPY AVAILABLE

INTRODUCTION

THIS IS ONE OF A SERIES OF ENVIRONMENTAL EDUCATION PRESENTATIONS PRODUCED THROUGH FUNDING OF PUBLIC LAW 91-516, THE ENVIRONMENTAL EDUCATION ACT, AS A PORTION OF THE ENVIRONMENTAL EDUCATION PROJECT, "A PROBLEM APPROACH." THE PRESENTATIONS WERE DEVELOPED THROUGH THE COOPERATIVE EFFORTS OF THE FOLLOWING GROUPS: GREEN BAY AREA CHAMBER OF COMMERCE; PUBLIC SCHOOL DISTRICT OF GREEN BAY; THE DEPARTMENT OF EDUCATION, DIOCESE OF GREEN BAY; THE I.C.E. PROJECT, WITH HEADQUARTERS AT CESA 9; THE LEAGUE OF WOMEN VOTERS OF GREATER GREEN BAY; WOMEN FOR ENVIRONMENTAL BALANCE; AND BROWN COUNTY CONSERVATION ALLIANCE -- ALL OF THE GREEN BAY, WISCONSIN AREA -- AND THE ENVIRONMENTAL QUALITY COUNCIL, INC. OF APPLETON, WISCONSIN.

THE PRESENTATIONS ARE INTENDED TO BE EDUCATIONAL, AND THEY ARE NOT NECESSARILY ENTERTAINING. THEY ARE UNLIKE MOST RADIO OR TELEVISION PROGRAMS. THE SUBJECTS ARE SERIOUS, AND YOU, THE AUDIENCE, WILL BE ASKED TO PLAY ROLES IN MAKING THE PRESENTATIONS WORTH YOUR TIME TODAY. YOU WILL BE ASKED TO PARTICIPATE IN A NUMBER OF SHORT DISCUSSIONS AT INTERVALS DURING THE AUDIO-SLIDE PRESENTATION. AT THOSE TIMES YOU WILL BE ASKED TO EXPRESS YOUR VIEWPOINT, AND TO OFFER YOUR KNOWLEDGE ON THE VARIOUS SUBJECTS.

IN ORDER FOR YOU TO BE EFFECTIVE IN THE DISCUSSIONS, I ASK THAT YOU GIVE CLOSE ATTENTION TO THE AUDIO PORTION OF THE PRESENTATION AS WELL AS TO THE COLOR SLIDES. TO BRIEFLY FAMILIARIZE YOU WITH THE COLOR SLIDES, I ASK THAT, IN A FEW MOMENTS, THE PRESENTATION LEADER TURN OFF THE AUDIO TAPE AND RAPIDLY RUN THROUGH ALL OF THE COLOR SLIDES IN THE PRESENTATION. AFTER

THE SLIDE PREVIEW, YOUR LEADER SHOULD RETURN THE SLIDE TRAY TO THE NUMBER ONE SLIDE POSITION SO THAT THE SLIDES WILL REAPPEAR IN THE PROPER SEQUENCE LATER DURING THE PRESENTATION. THE REASON FOR THIS SLIDE PREVIEW IS THAT MOST OF THE MESSAGE OF THIS ENVIRONMENTAL PROBLEMS PRESENTATION IS FOUND IN THE AUDIO PORTION. THE COLOR SLIDES ARE USED TO REINFORCE SOME OF THE IDEAS PRESENTED ON THE AUDIO TAPE. PLEASE TURN OFF THE TAPE RECORDER NOW AND RAPIDLY RUN THROUGH THE COLOR SLIDES. WHEN YOU ARE FINISHED START THE TAPE RECORDER AT THIS POINT AND BEGINNING WITH INTRODUCTION SLIDE NUMBER ONE, CHANGE SLIDES WHEN YOU HEAR THE FOLLOWING SOUND (BONG).

* INTRO 1 THE BASIC QUESTION THIS PRESENTATION SPEAKS TO IS, "WHAT WILL LIFE BE LIKE IN THE FUTURE?" MANY PEOPLE PREDICT A FAIRLY GLOOMY FUTURE. SOME SUGGEST THAT OUR CHILDREN, OUR GRANDCHILDREN, AND THEIR CHILDREN AND GRANDCHILDREN WILL BE LIVING IN OVERCROWDED, GLASSED-IN, CLIMATE CONTROLLED

* INTRO 2 CITIES. THE CITIES WILL BE SURROUNDED BY A BARREN COUNTRYSIDE -- A COUNTRYSIDE WITH UNBREATHABLE AIR AND A COUNTRYSIDE COVERED WITH NON-BIODEGRADABLE JUNK OF CIVILIZATION. OTHERS SUGGEST THAT THE WORLD WILL BE FULL OF BILLIONS OF MENTALLY SICK PEOPLE, ALL LIVING IN SMALL, SCATTERED COLONIES ACROSS THE FACE OF THE LAND -- EACH COLONY TRYING TO EKE OUT AN EXISTENCE, AND EACH COLONY FORTIFIED TO PROTECT IT FROM THE THREAT OF NEIGHBORING COLONIES.

* INTRO 3 OTHER PEOPLE PORTRAY A MUCH DIFFERENT, A VERY CONTRASTING PICTURE, A BRIGHT PICTURE OF A WORLD FULL OF GRAND SCIENTIFIC, SOCIOLOGICAL, AND TECHNOLOGICAL ACHIEVEMENTS. THESE FUTURISTS SUGGEST THAT THERE WILL BE A HIGH LIFE QUALITY FOR PEOPLE EVERYWHERE. THEY SUGGEST THAT THE FOOD NEEDS OF ALL PEOPLE WILL BE MET -- THAT WE WILL HAVE NO TRANSPORTATION

PROBLEMS -- WE WILL HAVE NO PROBLEMS WITH ENERGY -- NO PROBLEMS WITH OUR TERRITORIES -- AND THAT LIFE WILL BE A VERY RICH QUALITY.

NONE OF US REALLY KNOW WHAT THE FUTURE HOLDS. WE DO KNOW THAT IT IS VERY IMPORTANT THAT WE PLAN FOR THE FUTURE. WE ARE USED TO PLANNING -- WE PLAN FOR OUR NEXT MEAL; WE PLAN FOR OUR LEISURE TIME ACTIVITIES ON WEEKENDS; WE PLAN FOR VACATIONS; AND WE PLAN FOR RETIREMENT. WE NEED TO PLAN MUCH FURTHER AHEAD. WE MUST PLAN FOR THE FUTURE LIFE QUALITY OF PEOPLE WHO MAY NOT YET BE BORN FOR ANOTHER ONE HUNDRED OR ONE THOUSAND YEARS. WE ALL HAVE A STAKE IN THE FUTURE AND WE HAVE AN OBLIGATION TO HELP PLAN FOR THAT FUTURE. IT IS NOT GOING TO "JUST HAPPEN" BECAUSE SOMEONE SOMEWHERE IS LOOKING OUT FOR EVERYONE ELSE.

* INTRO 4 WALTER J. HICKEL, FORMER SECRETARY OF THE UNITED STATES DEPARTMENT OF INTERIOR, SUGGESTS THIS IN HIS BOOK, WHO OWNS AMERICA?. IN THIS BOOK HICKEL ASKS, "WHO IS RESPONSIBLE FOR AMERICA'S FUTURE?" HE ANSWERS THAT YOU AND I OWN AMERICA AND THAT WE SHARE A GREAT RESPONSIBILITY IN ITS FUTURE. MR. HICKEL SUGGESTS THAT AMERICA'S FUTURE DEPENDS TO A LARGE DEGREE ON OUR NATURAL RESOURCES. I AGREE, BUT I THINK IT SHOULD BE EMPHASIZED THAT OUR FUTURE DEPENDS MOST ON WHAT WE PEOPLE DO WITH OUR NATURAL RESOURCES.

IF WE LOOK AT OUR PAST BEHAVIORS ON THE USE OF OUR RESOURCES, WE REALIZE THAT WE HAVE CREATED A NUMBER OF SEVERE ENVIRONMENTAL PROBLEMS. NOW WE ARE FACED WITH THE JOB OF SOLVING OUR PAST AND PRESENT ENVIRONMENTAL PROBLEMS AND LOOKING AHEAD TO PREVENT THE DEVELOPMENT OF ADDITIONAL PROBLEMS. IN THE PAST WE HAVE USED AMERICA'S RESOURCES AND MUCH OF THE WORLD'S RESOURCES TO PROVIDE US WITH A STANDARD OF LIVING UNPARALLELED

IN THE HISTORY OF MAN. MOST AMERICAN'S HAVE FARED PRETTY WELL WHEN IT COMES TO MATERIAL POSSESSIONS. BUT IN ASKING FOR THE KIND OF LIFE STYLE THAT WE WANT, WE FAILED, UNTIL RECENTLY, TO RECOGNIZE THAT THESE MATERIAL POSSESSIONS AND OUR LIFE STYLE HAVE A VERY HIGH PRICE. WE HAVE STARTED TO PAY THE PRICE -- THE ENVIRONMENTAL PRICE -- IN MANY WAYS.

* INTRO 5 WE ARE ALL AWARE OF THE PROBLEMS WE HAVE HAD WITH OUR AIR QUALITY, PROBLEMS WITH WATER QUALITY, LAND USE, PROBLEMS OF DISPOSING OF OUR SOLID AND SANITARY WASTE MATERIALS, AND PROBLEMS OF GETTING WHERE WE WANT TO GO, WHEN WE WANT TO GO. WE ARE ALL AWARE OF THESE EVENTS AND WE ARE AWARE OF THESE PRICES -- AT LEAST PARTLY AWARE. MANY OF US ARE CONCERNED -- AT LEAST A LITTLE CONCERNED. AND SOME PEOPLE HAVE BEEN ACTIVE IN SEEKING SOLUTIONS TO VARIOUS ENVIRONMENTAL PROBLEMS -- AT LEAST SOMEWHAT ACTIVE. I DON'T THINK WE CAN AFFORD TO BE PARTLY AWARE, A LITTLE CONCERNED, AND SOMEWHAT ACTIVE. EACH OF US CAN AND SHOULD PLAY VARIOUS ROLES IN SOLVING ENVIRONMENTAL PROBLEMS AND ROLES IN WORKING TOWARD REASONABLE AND HEALTHY LIFE QUALITY FOR PEOPLE IN THE FUTURE.

OF COURSE, NOBODY, NOT EVEN THE EXPERTS, CAN TACKLE ALL PARTS OF ALL PROBLEMS. NO ONE PERSON OR SMALL GROUP OF PEOPLE HAS THAT KIND OF EXPERTISE. EACH PROBLEM IS COMPLEX AND MOST ARE VERY MUCH INTERRELATED. EACH PROBLEM NOT ONLY HAS AN ECONOMIC AND POLITICAL PART, BUT IT HAS PARTS THAT DEAL WITH SOCIAL ISSUES, PARTS THAT MAY REQUIRE TECHNOLOGICAL OR SCIENTIFIC ANSWERS, AND PARTS THAT ARE VERY MUCH VALUE ISSUES. ALSO, ANY PROPOSED SOLUTION TO ANY ONE PROBLEM IS GOING TO AFFECT ATTEMPTS TO SOLVE OTHER PROBLEMS. IT IS APPARENT THAT SIMPLE AND EASY SOLUTIONS WILL NOT SUFFICE TO CORRECT ANY ONE ENVIRONMENTAL PROBLEM.

* INTRO 6 IN THE PAST WE HAVE OFTEN LOOKED AT OUR PROBLEMS IN MUCH THE SAME WAY THAT BLIND MEN LOOKED AT AN ELEPHANT. EACH OF THE BLIND MEN VISUALIZED ONLY A PART OF THE ELEPHANT -- THAT PART THAT WAS CLOSEST TO HIM. WHEN IT COMES TO ENVIRONMENTAL ISSUES, THE PARTS THAT MOST OF US SEE ARE THE ONES THAT ARE THE CLOSEST TO OUR LIVES -- USUALLY THE PARTS THAT ARE CLOSEST TO OUR POCKETBOOKS. IN ORDER TO GET A TRUE PICTURE OF AN ELEPHANT, THE BLIND MEN FOUND IT NECESSARY TO COMBINE THEIR VIEWPOINTS. LIKEWISE WITH ENVIRONMENTAL PROBLEMS. MANY DIFFERENT PEOPLE WITH MANY DIFFERENT TALENTS, ABILITIES, AND VIEWPOINTS ARE GOING TO HAVE TO COMBINE EFFORTS TO GET THE TRUE PICTURE OF ANY ONE ENVIRONMENTAL PROBLEM. THESE SAME PEOPLE ARE GOING TO HAVE TO BE ABLE TO TALK TO EACH OTHER AND WORK COOPERATIVELY TO SOLVE THE PROBLEMS. AMERICA'S SCIENTISTS, AMERICA'S SOCIOLOGISTS, AMERICA'S LEGISLATORS -- NONE OF THEM HAVE SUFFICIENT EXPERTISE IN ENOUGH AREAS TO SOLVE OUR ENVIRONMENTAL PROBLEMS WITHOUT PUBLIC INPUT -- WITHOUT YOUR SUPPORT.

MOST EXPERTS KNOW THIS, AND THEY ASK FOR PEOPLE'S OPINIONS AND KNOWLEDGE. CERTAINLY, SOME SO-CALLED EXPERTS LIKE PEOPLE IN ANY WALK OF LIFE, CONSIDER THEMSELVES TO BE KNOW-IT-ALLS -- AND THEY ARE DIFFICULT TO WORK WITH. BUT BY AND LARGE, THE PEOPLE WHO ARE CURRENTLY MAKING THE DECISIONS ABOUT OUR LIFE QUALITY ARE VERY MUCH INTERESTED IN THE GUIDANCE AND SUPPORT OF THE

* INTRO 7 AMERICAN PUBLIC. YOUR VOICE IS NEEDED TO HELP BRING ABOUT LASTING SOLUTIONS TO ENVIRONMENTAL PROBLEMS. YOUR VOICE AND EFFORTS CAN TAKE MANY FORMS. ONE SUCH FORM IS PRACTICING ENVIRONMENTALLY SOUND BEHAVIORS IN DAILY LIVING. SOME ROLES WE CAN ALL PLAY INVOLVE EXPRESSING IDEAS AND PROVIDING INFORMATION AT PUBLIC MEETINGS. CERTAINLY WE CAN DO THIS AT THE LOCAL LEVEL AND POSSIBLY AT THE STATE AND NATIONAL LEVEL. OTHER PLANNING ROLES MAY INVOLVE

LETTER WRITING -- TELEPHONING. THEY INVOLVE COMMUNICATIONS WITH RADIO AND TELEVISION STATIONS AND WITH NEWSPAPERS. SOME ROLES MAY BEST BE PLAYED THROUGH YOUR MEMBERSHIP IN ORGANIZATIONS AND THROUGH ORGANIZATIONAL ENDORSEMENT OF LEGISLATION OR POLICIES THAT AFFECT FUTURE LIFE QUALITY.

* INTRO 8 THE MAIN OBJECTIVES OF THIS PRESENTATION AND OF THE OTHERS IN THIS SERIES ARE TO HELP YOU BECOME MORE AWARE OF SOME OF OUR ENVIRONMENTAL PROBLEMS AND TO HELP YOU, THROUGH YOUR DISCUSSIONS, TO FIND ROLES YOU CAN PLAY IN BRINGING ABOUT LASTING SOLUTIONS TO THESE PROBLEMS.

YOUR DISCUSSION LEADER HAS COPIES OF SOME QUESTIONS THAT WILL BE RAISED DURING THIS PRESENTATION. AT TWO OR THREE TIMES I WILL ASK THE PRESENTATION LEADER TO STOP THE AUDIO TAPE AND THE SLIDES, TO PROVIDE YOU WITH TIME FOR DISCUSSION. JUST BEFORE THE TAPE IS STOPPED, I WILL REPEAT THE QUESTIONS AND YOU AND YOUR DISCUSSION LEADER CAN DECIDE ON THE AMOUNT OF TIME YOU FEEL YOU CAN DEVOTE TO DISCUSSION. I MAY HAVE PARTLY ANSWERED SOME OF THE QUESTIONS. IN YOUR DISCUSSIONS YOU MAY FIND IT USEFUL TO ADD TO, PULL APART, OR REJECT THE ANSWERS THAT I OFFER. THE JOB OF ANSWERING QUESTIONS AND THE JOB OF ASKING BETTER QUESTIONS WILL BE YOURS.

YOU SEE, WE SO-CALLED EXPERTS DON'T HAVE ALL THE ANSWERS AND THE FINAL ANSWERS IN THESE CHANGING TIMES WILL HAVE TO COME FROM YOU AND FROM ME AND FROM MANY OTHER PEOPLE.

SUMMARY

* SUMMARY 1 IT WAS NOT THE PURPOSE OF THIS SLIDE PRESENTATION TO PROVIDE SOLUTIONS TO OUR ENVIRONMENTAL PROBLEMS. THE FACT OF THE MATTER IS THE PRIMARY GOAL OF THIS AND THE OTHER PRESENTATIONS IN THIS SERIES IS TO CONVINCE YOU THAT YOUR VOICE, YOUR OPINION IS IMPORTANT, AND TO MOTIVATE YOU TO EXPRESS YOUR IDEAS TO THE PEOPLE WHO ARE CURRENTLY PLANNING THE ENVIRONMENT OF YOUR FUTURE.

I AM SURE YOU HAVE NOTICED THAT I HAVE PROVIDED SOME BACKGROUND INFORMATION AND RAISED SOME QUESTIONS BUT OFFERED NO SOLUTIONS. BEFORE SOLUTIONS TO ENVIRONMENTAL PROBLEMS CAN BE ACCOMPLISHED, PEOPLE MUST TAKE STOCK OF THEIR VALUES AND THEIR GOALS. THEY MUST DECIDE WHAT IS IMPORTANT IN LIFE -- NOT JUST IMPORTANT TO THEM -- NOW -- BUT TO PEOPLE IN THE FUTURE. WE MUST CONTINUE TO SEEK ANSWERS TO QUESTIONS ABOUT THE AMOUNTS AND KINDS OF RESOURCES -- NATURAL AND HUMAN -- THAT WILL BE NEEDED TO INSURE A FIT ENVIRONMENT FOR PEOPLE.

* SUMMARY 2 IN THE INTRODUCTION TO THE PRESENTATION, I MENTIONED THAT SOME FUTURISTS PORTRAY A COMING ERA OF GRAND SCIENTIFIC, TECHNOLOGICAL, AND SOCIOLOGICAL ACHIEVEMENTS. BEFORE WE TOO READILY ACCEPT THIS VIEW OF THE FUTURE, I THINK IT NECESSARY TO POINT OUT A FEW MYTHS AND FACTS REPORTED RECENTLY IN AN EVALUATION OF WORLD ENVIRONMENTAL QUALITY BY THE NATIONAL WILDLIFE FEDERATION IN COOPERATION WITH THE FIRST UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT.

THE FIRST COMMONLY HELD MYTH IS THAT BY TECHNOLOGY AND BY USING THE OCEANS WE CAN FEED THE WORLD. THIS IS FOLLOWED WITH THE FACT THAT THE GREEN REVOLUTION IS BUT A SHOT IN THE ARM. POPULATION GROWTH IS NEUTRALIZING FOOD PRODUCTION GAINS ACROSS THE WORLD. BUT PER CAPITA PROTEIN INTAKE RIGHT NOW ACROSS THE WORLD IS WORSE THAN IT WAS A DECADE AGO. THIS

IS ALSO FOLLOWED BY THE FACT THAT THE OCEANS ARE 90 PERCENT BIOLOGICAL DESERTS AND THE OTHER 10 PERCENT OF THE OCEANS ARE ALREADY IN DANGER OF BEING OVEREXPLOITED.

ANOTHER POPULAR MYTH IS THAT WARS, DISEASE, AND NATURAL DISASTERS WILL CONTROL SURPLUS HUMAN POPULATION. THE FIRST FACT THEY POINT OUT IS THAT IN FIVE TERRIBLE YEARS OF WAR, THE POPULATIONS OF NORTH AND SOUTH VIETNAM HAVE GROWN BY MORE THAN THREE MILLION PEOPLE. A SECOND FACT, THAT ALTHOUGH A GIANT TIDAL WAVE KILLED MORE THAN 500,000 PEOPLE IN EAST PAKISTAN IN 1970, THAT NUMBER -- ONE-HALF MILLION -- WAS REPLACED IN JUST 35 DAYS. AND A THIRD FACT, THAT IMPROVED HEALTH CARE AND MODERN MEDICINES HAVE LENGTHENED WESTERN MAN'S LIFE SPAN BY TWO DECADES SINCE THE YEAR 1900.

AS YOU CAN SEE, I AM NOT ATTEMPTING TO PLAY DOWN THE SEVERITY OF ENVIRONMENTAL PROBLEMS. BUT BY THE SAME TOKEN, THERE IS ABSOLUTELY NO FUTURE IN ASSUMING A PESSIMISTIC POSITION -- PESSIMISM RESULTS IN FAILURE TO TAKE ACTION, AND FAILURE TO TAKE ACTION, IN TURN, MOST LIKELY WILL RESULT IN THE DOOMSDAY FUTURE THAT MANY PORTRAY.

* SUMMARY 3 IN 1969 PRESIDENT NIXON APPROACHED A MAJOR FACTOR INFLUENCING ALL OUR ENVIRONMENTAL PROBLEMS WITH THIS STATEMENT:

> "ONE OF THE MOST SERIOUS CHALLENGES TO HUMAN DESTINY IN THE LAST THIRD OF THIS CENTURY WILL BE THE GROWTH OF THE POPULATION. WHETHER MAN'S RESPONSE TO THAT CHALLENGE WILL BE A CAUSE FOR PRIDE OR FOR DESPAIR IN THE YEAR 2000 WILL DEPEND VERY MUCH ON WHAT WE DO TODAY. IF WE NOT BEGIN OUR WORK IN AN APPROPRIATE MANNER, AND IF WE CONTINUE TO DEVOTE A CONSIDERABLE AMOUNT OF ATTENTION AND ENERGY TO THIS PROBLEM, THEN MANKIND WILL BE ABLE TO SURMOUNT THIS CHALLENGE AS IT HAS SURMOUNTED SO MANY DURING THE LONG MARCH OF CIVILIZATION."

THIS STATEMENT APPEARS IN THE PREFACE TO THE BOOK POPULATION AND THE AMERICAN FUTURE, WHICH IS THE REPORT OF THE COMMISSION ON POPULATION GROWTH AND THE AMERICAN FUTURE.

STATEMENTS OF PHILOSOPHY ARE IMPORTANT, BUT WE MUST CONTINUE TO ASK QUESTIONS AND CONTINUE TO ACT. WE NEED TO ASK QUESTIONS ABOUT HOW OUR

* SUMMARY 4 ENVIRONMENTAL DECISIONS ARE CURRENTLY BEING MADE. WE NEED TO ASK QUESTIONS ABOUT WHAT PRESENT LAWS AND POLICIES, WHAT PERSONAL AND PUBLIC VIEWPOINTS AND BEHAVIORS REGULATE THE USE AND DISTRIBUTION OF OUR NATURAL RESOURCES AND OUR HUMAN TALENTS.

THE TWO FREE PUBLICATIONS SHOWN HERE, "CONSERVATION REPORT" AND "CONSERVATION NEWS," WILL HELP YOU KEEP UP ON FEDERAL LEGISLATION AND POLICIES. THEY ARE AVAILABLE FROM THE NATIONAL WILDLIFE FEDERATION, AT 1412 - 16TH STREET N.W. IN WASHINGTON, D.C. THE "CONSERVATION REPORT," USUALLY ABOUT EIGHT PAGES IN LENGTH, IS A WEEKLY PUBLICATION OFFERED WHILE CONGRESS IS IN SESSION. IT GIVES WELL WRITTEN, REASONABLY DETAILED FACTUAL INFORMATION ON THE STATUS OF ALL ENVIRONMENTAL LEGISLATION BEING PROPOSED, DISCUSSED, OR AMENDED IN WASHINGTON. THE "CONSERVATION NEWS," SIMILAR IN SIZE, IS PUBLISHED EVERY TWO WEEKS.

* SUMMARY 5 SOME ENVIRONMENTAL PLANNING ROLES WE CAN ASSUME MIGHT BE CALLED EDUCATIONAL ROLES. OTHERS MIGHT BE CALLED ACTION ROLES. WE CAN AND DO INFLUENCE OUR FAMILIES, NEIGHBORS, AND THE PEOPLE WE ASSOCIATE WITH AT WORK AND PLAY. BEFORE WE CAN BE EFFECTIVE EDUCATORS WE MUST BECOME EDUCATED. THE ENVIRONMENTAL PROTECTION AGENCY MATERIALS THAT ACCOMPANY THIS PRESENTATION ARE AN EXCELLENT BEGINNING IN EDUCATING OURSELVES. I SUGGEST THAT YOU BEGIN WITH A SMALL BOOKLET TITLED "DON'T LEAVE IT ALL TO THE EXPERTS," AND SUBTITLED "THE CITIZEN'S ROLES IN ENVIRONMENTAL DECISION MAKING." INDIVIDUAL COPIES OF THIS AND MANY OTHER EXCELLENT ENVIRONMENTAL PROTECTION AGENCY PUBLICATIONS CAN BE OBTAINED AT NO COST FROM YOUR REGIONAL ENVIRONMENTAL PROTECTION AGENCY OFFICE. THE REGIONAL

OFFICE IN THIS AREA IS IN CHICAGO, AT ONE NORTH WACKER DRIVE, 60606. ADDITIONAL COPIES OF THIS AND OTHER EXCELLENT E.P.A. PUBLICATIONS ARE AVAILABLE AT NOMINAL PRICES FROM THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE IN WASHINGTON, D.C. 20402.

THE SECOND BOOK SHOWN HERE ENTITLED E.P. THE NEW CONSERVATION IS PUBLISHED BY THE IZAAK WALTON LEAGUE OF AMERICA. IT OFFERS EXCELLENT SUGGESTIONS FOR PEOPLE WHO WANT TO GET INVOLVED, INVOLVED IN ENVIRONMENTAL PRACTICES, INVOLVED IN ENVIRONMENTAL DECISION MAKING, AND IN ENVIRONMENTAL BEHAVIORS. THIS IS AVAILABLE THROUGH THE IZAAK WALTON LEAGUE OF AMERICA, AND IT COSTS $1.25.

THE TWO BOOKS CAN SERVE AS A BEGINNING. MANY AGENCIES OFFER OTHER RESOURCES -- BOTH IN PRINTED MATERIALS AND IN PEOPLE -- TO ASSIST YOU.

* SUMMARY 6 BUT THE ACTIONS OF YOU AND YOUR GROUP ARE THE STARTING POINT.

FINALLY, I THINK IT IS APPROPRIATE THAT WE ASK WHAT CONTRIBUTIONS WE CAN MAKE TO THE ENVIRONMENTAL EDUCATION OF OUR YOUTH. HOW CAN WE AS INDIVIDUALS AND GROUPS SUPPORT ENVIRONMENTAL EDUCATION IN OUR SCHOOLS AND IN OTHER COMMUNITY INSTITUTIONS AND ORGANIZATIONS? THIS FINAL SLIDE SHOWS JUNIOR HIGH SCHOOL STUDENTS FROM GREEN BAY, WISCONSIN, HELPING PRE-SCHOOL CHILDREN LEARN ABOUT A PART OF THEIR ENVIRONMENT.

OUR YOUTH WILL INHERIT A MUCH BIGGER PART OF THE FUTURE THAN YOU AND I. THERE IS NO TIME LIKE THE PRESENT TO BEGIN HELPING OUR YOUTH PREPARE FOR THAT FUTURE.

ECOLOGICAL CONCEPTS

*1 MUCH OF THE FOLLOWING PRESENTATION WAS FROM A DISCUSSION LED BY DR. HALLETT HARRIS, OF THE UNIVERSITY OF WISCONSIN AT GREEN BAY. THE SUBJECT WAS ECOLOGY. THE WORD "ECOLOGY" MAY NOW BE A HOUSEHOLD WORD, BUT IT STILL NEEDS SOME DEFINING. WHAT IS ECOLOGY? ECOLOGY IS A BRANCH OF THE NATURAL SCIENCES. IT'S THE STUDY OF THE RELATIONSHIP BETWEEN LIVING THINGS AND THE ENVIRONMENTS IN WHICH THEY LIVE. THE WORDS "ECOLOGY" AND "ENVIRONMENT" ARE NOT THE SAME, EVEN THOUGH MANY PEOPLE USE THE TWO WORDS INTERCHANGEABLY. ECOLOGY, ALTHOUGH A RELATIVELY NEW SCIENTIFIC DISCIPLINE, IS OLD IN ONE SENSE. FOR THOUSANDS OF YEARS PEOPLE HAVE OBSERVED, WONDERED ABOUT, AND RECORDED THE OBJECTS AND WORKINGS OF NATURE. PEOPLE LEARNED MUCH FROM THIS DESCRIPTIVE SORT OF STUDY, THIS NATURAL HISTORY SORT OF STUDY. BUT ECOLOGY AS A SCIENCE IS FAIRLY NEW AND IS STILL GROWING. TODAY ECOLOGISTS USE A KNOWLEDGE LEARNED IN THE FIELDS OF PHYSICS, CHEMISTRY, BIOLOGY, GEOLOGY, AND MATHEMATICS TO DESCRIBE AND UNDERSTAND THE REAL WORLD.

*2 ECOLOGISTS USE MANY SOPHISTICATED METHODS AND TOOLS. THEY USE THEM TO HELP IN THE ANALYSIS OF REAL EVENTS AND TO HELP THEM PREDICT THE EFFECTS OF CHANGES ON NATURAL ENVIRONMENTS. I THINK IT IS TIME WE USE OUR NEW KNOWLEDGE OF ECOLOGY TO HELP US UNDERSTAND BOTH NATURAL AND MAN-DOMINATED ENVIRONMENTS, AND TO HELP US PREDICT THE EFFECTS OF OUR ACTIONS ON THESE ENVIRONMENTS.

THE SCIENCE OF PHYSICS, FOR EXAMPLE, HAS PROVIDED US WITH INSIGHTS INTO THE LAWS OF GRAVITY AND INERTIA. FROM CHEMISTRY AND PHYSICS WE HAVE LEARNED ABOUT THE LAWS THAT GOVERN THE BEHAVIOR OF ATOMS AND MOLECULES. WE HAVEN'T IGNORED THESE LAWS. WE HAVE USED THIS KNOWLEDGE AND OTHER INFORMATION AS GUIDELINES IN DECISION MAKING.

ECOLOGICAL CONCEPTS

EQUALLY, GOD HAS PROVIDED US WITH LAWS, PRINCIPLES, IDEAS. THESE IDEAS HAVE OFTEN BEEN IGNORED IN DECISIONS WE HAVE MADE ABOUT ENVIRONMENTS. IGNORING GRAVITY CAN BRING RAPID AND DISASTROUS RESULTS. WE ARE LEARNING, SOMETIMES THE HARD WAY, THAT IGNORING ECOLOGICAL LAWS CAN ALSO LEAD TO DISASTROUS RESULTS. WE NEED TO GET INTO THE HABIT OF USING OUR KNOWLEDGE OF ECOLOGICAL CONCEPTS IN MAKING DECISIONS THAT AFFECT THE ENVIRONMENTS IN WHICH PEOPLE LIVE.

*3 LET'S LOOK AT SOME IDEAS WE HAVE GAINED FROM OUR STUDY OF ECOLOGY. A FUNDAMENTAL CONCEPT IN ECOLOGY IS THAT OF THE "ECOSYSTEM." THE ECOSYSTEM IS SORT OF A CONCEPTUAL UNIT, BECAUSE ECOSYSTEMS COME IN A VARIETY OF KINDS AND SIZES. ALL ECOSYSTEMS DO HAVE SOME THINGS IN COMMON, HOWEVER. AN ECOSYSTEM, WHETHER IT IS AS SMALL AS A PARK POND OR AS LARGE AS A LARGE NATURAL FOREST, IS MADE UP OF BIOTIC (LIVING) AND ABIOTIC (NONLIVING) THINGS, AND THESE LIVING AND NONLIVING THINGS INTERACT. THEY INTERACT WITH EACH OTHER, AND THE VARIOUS MEMBERS INTERACT AMONG THEMSELVES. TODAY WE UNDERSTAND SOME OF THE INTERACTIONS QUITE WELL. OTHERS ARE JUST BEING DISCOVERED AND, NO DOUBT, MANY INTERACTIONS, MORE SUBTLE, ARE YET TO BE DEFINED. BUT OF ONE THING WE ARE CERTAIN. THERE ARE MANY KINDS OF INTERACTIONS AND THEY ARE COMPLEX.

TODAY WE WILL HAVE TIME TO DISCUSS ONLY A FEW OF THESE INTERACTIONS. MANY OF THE BOOKS ON THE READING LIST THAT ACCOMPANIES THIS PRESENTATION CAN INFORM YOU OF SOME OF THE MORE SPECIFIC AND MORE COMPLEX ONES AND LEAD TO QUESTIONS THAT MIGHT HELP YOU IN LEARNING HOW TO USE THIS INFORMATION IN ENVIRONMENTAL DECISION MAKING.

IT'S IMPORTANT TO POINT OUT THAT MANY OF OUR ENVIRONMENTAL PROBLEMS ARE THE RESULT OF PEOPLE ALTERING ECOLOGICAL INTERACTIONS. OFTEN WE INTENTIONALLY SIMPLIFY ECOSYSTEM INTERACTIONS. IN DOING THIS, WE OFTEN DISTURB THESE

ECOSYSTEMS BY MAKING THEM MORE SIMPLE THAN THEY CAN BE IN ORDER FOR THEM
*4 TO FUNCTION PROPERLY.

LET'S DISCUSS THE LIVING COMPONENTS OF THE ECOSYSTEMS FIRST. ALL LIVING THINGS ARE DIFFERENT IN MANY WAYS, AND YET ALL LIFE HAS CERTAIN COMMON NEEDS. ENERGY IS ONE COMMON NEED. LIVING THINGS ARE SOMEWHAT LIKE MANUFACTURING INDUSTRIES. THEY BOTH USE ENERGY TO DO THE WORK OF ASSEMBLING RAW MATERIALS INTO CERTAIN PRODUCTS. BOTH INDUSTRIES AND LIVING THINGS PRODUCE WASTE MATERIALS. THE MAIN PRODUCTS OF LIVING THINGS ARE TISSUE AND NEW LIFE. THE RAW MATERIALS FOR LIVING THINGS ARE MINERALS, WATER, AND PARTS OF THE AIR. LIVING THINGS REQUIRE SPACE IN WHICH TO FUNCTION. INDIVIDUAL LIVING THINGS NEED ENOUGH SPACE IN WHICH TO GET THE NECESSARY RAW MATERIALS FOR THEM TO GROW.

*5 MOST LIVING THINGS CAN BE CLASSIFIED AS PLANTS, ANIMALS, OR MICROORGANISMS -- "MICROBES" FOR SHORT. THE MEMBERS OF THESE GROUPS DIFFER IN FORM AND FUNCTION. MOST PLANTS ARE RELATIVELY STATIONARY. GREEN PLANTS DON'T NEED TO MOVE AROUND TO OBTAIN ENERGY -- THEY USE THE ENERGY OF SUNLIGHT, AND THEY GROW IN PLACES WHERE THEY HAVE ENOUGH SPACE TO OBTAIN THEIR REQUIRED MINERALS, WATER, AND OXYGEN AND CARBON DIOXIDE FROM THE AIR OR THE WATER. IN TERMS OF LIFE STYLE, GREEN PLANTS ARE OFTEN CALLED AUTOTROPHS -- THAT IS "SELF-NOURISHING." THEY ARE ALSO OFTEN REFERRED TO AS "PRODUCERS" -- THEY PRODUCE ENERGY-RICH ORGANIC MATERIAL -- FOOD. THEY DO THIS BY A PROCESS WE CALL "PHOTOSYNTHESIS." IN THIS PROCESS, THEY PRODUCE CARBOHYDRATES FROM CARBON DIOXIDE AND WATER, USING THE SUN'S ENERGY TO BRING ABOUT THE SYNTHESIS -- THE PUTTING TOGETHER OF THESE MOLECULES. LAND PLANTS OBTAIN CARBON DIOXIDE FROM AIR. AQUATIC PLANTS GET CARBON DIOXIDE
*6 *7 FROM THE WATER. HERE ARE SOME SLIDES OF SOME PRODUCERS.

ECOLOGICAL CONCEPTS

ANIMALS AND MOST MICROBES ARE CLASSIFIED AS "HETEROTROPHS" -- THAT IS "OTHER NOURISHING." LACKING CERTAIN GREEN COLORED PIGMENTS AND CERTAIN REQUIRED ENZYMES, ANIMALS AND MOST MICROBES ARE UNABLE TO CARRY ON THE FOOD MAKING PROCESS OF PHOTOSYNTHESIS.

*8 MOST ANIMALS AND SOME MICROBES ARE CALLED CONSUMERS. THEY OBTAIN NEEDED ENERGY FROM CHEMICALLY BREAKING DOWN THE FOOD PRODUCED BY PLANTS. THE ANIMALS THAT EAT PLANT PARTS -- THE SEED EATERS AND THE BROWSERS OR GRAZERS -- ARE CALLED HERBIVORES. THEIR FOOD ENERGY IS BUT ONE STEP AWAY

*9 FROM THE SUN. THROUGH THEIR FOOD, HERBIVORES AND OTHER CONSUMERS DERIVE THEIR MINERALS AND SOME OF THEIR NEEDED WATER. THE AIR OR WATER -- DEPENDING UPON THEIR ENVIRONMENT AND THEIR STRUCTURAL ADAPTATION -- SUPPLIES THE NEEDED OXYGEN. OXYGEN IS NEEDED BY BOTH PLANTS AND ANIMALS AND BY MOST MICROBES. SOME MICROORGANISMS, THE ANAEROBES, DON'T NEED OXYGEN. MOST LIVING THINGS NEED OXYGEN IN ORDER TO "OXIDIZE" -- SORT OF BURN OR COMBUST -- THE FOOD MOLECULES IN ORDER TO RELEASE STORED FOOD ENERGY.

*10 THIS ENERGY THAT'S NEEDED FOR GROWTH, BODY MOVEMENT, AND BODY REPAIR RESULTS FROM A SORT OF "COMBUSTION" WE CALL RESPIRATION.

*11 CARNIVORES ARE TWO OR MORE STEPS AWAY FROM THE SUN. CAPNIVORES ARE ANIMALS THAT EAT OTHER ANIMALS. SOMETIMES THEY ARE REFERRED TO AS SECOND ORDER CONSUMERS. PREDATORS, FOR EXAMPLE, KILL AND EAT OTHER ANIMALS AND ARE THEREFORE CARNIVOROUS. PARASITES, SUCH AS FLEAS AND TAPEWORMS, DERIVE THEIR FOOD FROM LIVING ANIMALS AND THEY ARE ALSO CONSIDERED TO BE CARNIVOROUS. THOSE PARASITES THAT GET THEIR FOOD FROM PLANTS ARE

*12 CONSIDERED TO BE HERBIVORES. ANIMALS THAT HAVE A MIXED DIET -- EATING BOTH PLANT AND ANIMAL MATERIALS -- ARE CALLED OMNIVORES. PEOPLE ARE MORE OMNIVORE THAN ANYTHING ELSE.

BEST COPY AVAILABLE

*13 A THIRD MAJOR LIFE STYLE IS THAT OF THE DECOMPOSERS. MOST DECOMPOSERS --
*14 GREATER IN BOTH KINDS AND NUMBERS -- ARE THE MICROBES. THEY ARE THE
ECOSYSTEMS' SANITARY PERSONNEL -- THE TRUE RECYCLERS OF THE ECOSYSTEMS.
THE BODY CHEMISTRY OF PLANTS AND ANIMALS IS QUITE EFFICIENT, BUT NOT
EFFICIENT ENOUGH TO DERIVE ALL THE ENERGY AND MINERALS FROM THE FOOD
THAT IS PROCESSED. ANIMAL WASTE MATERIALS, FOR EXAMPLE, SUPPLY ENERGY
AND NEEDED MINERAL MATTER TO MANY MICROBES.
*15 LARGER DECOMPOSERS, THE SCAVENGERS, BEGIN THE BREAKDOWN OF DEAD ANIMAL
BODIES. OTHER LARGE ORGANISMS, THE SAPROPHYTES, BEGIN THE DECOMPOSITION
OF MUCH DEAD PLANT MATERIAL. THE MAIN GROUP OF SAPROPHYTES ARE THE
*16 VARIOUS FUNGI -- THE MOLDS, MILDEWS, MUSHROOMS, AND THE LIKE. WHEN THE
SAPROPHYTES AND SCAVENGERS HAVE DERIVED ALL THE FOOD MATERIAL THEY CAN
GET FROM DEAD PLANT AND ANIMAL REMAINS, THE SMALL DECOMPOSERS, THE
MICROBES, COMPLETE THE JOB -- AND THE DEATH OF THESE COUNTLESS MICROBES
RELEASES MINERAL MATTER BACK TO THE SOIL AND TO THE WATER.
IN A MOMENT I WOULD LIKE TO HAVE THE PRESENTATION LEADER TURN OFF THE
AUDIO TAPE AND SLIDE PROJECTOR TEMPORARILY SO THAT YOU CAN DISCUSS THE
FOLLOWING QUESTIONS. QUESTION ONE: A KEY PART OF THE WORD "ECOSYSTEM"
IS SYSTEM. IN ECOSYSTEMS THINGS INTERACT. THEY ACT ON EACH OTHER IN
MANY WAYS, BUT IN WAYS THAT ENABLE THE ECOSYSTEM TO OPERATE AS A TRUE SYSTEM.
CAN YOU DESCRIBE SOME OF THE INTERACTIONS THAT MAKE ECOSYSTEMS FUNCTION AS
SYSTEMS? QUESTION TWO: CAN YOU DESCRIBE SOME OF THE NATURAL EVENTS OR
PROCESSES THAT DETERMINE WHAT SPECIFIC KINDS OF LIVING THINGS, WHAT PLANTS
AND WHAT ANIMALS ARE ABLE TO LIVE IN VARIOUS DIFFERENT ECOSYSTEMS? WHEN
YOU HAVE FINISHED YOUR DISCUSSION, PLEASE RETURN TO THE AUDIO TAPE AND
SLIDE PRESENTATION.

ECOSYSTEMS THEN ARE SYSTEMS OF LIVING AND NONLIVING THINGS THROUGH WHICH ENERGY MOVES. NONLIVING MATERIALS -- WATER, PARTS OF THE AIR, AND MINERALS -- ALSO MOVE IN THESE SYSTEMS. YOU MAY HAVE DETECTED THE DIFFERENCE IN THE MANNER OF MOVEMENT OF ENERGY AND MATERIALS IN ECOSYSTEMS.

*17 THIS SLIDE ILLUSTRATES THE CYCLIC OR RECYCLING MOVEMENT OF MATERIALS IN ECOSYSTEMS. IN WELL BALANCED ECOSYSTEMS THERE IS RELATIVELY LITTLE WASTE OF INORGANIC MATERIALS. RESERVOIRS OF MATERIALS -- OFTEN CALLED NUTRIENT POOLS -- ARE SHOWN ON THE LEFT SIDE OF THIS SLIDE. ARROWS INDICATE THE MOVEMENT OF MATERIALS TO AND FROM NUTRIENT POOLS IN THE SYSTEM. NOTE THAT THE DECOMPOSERS ARE THE GROUP THAT RETURNS THE LARGEST AMOUNT AND THE LARGEST NUMBER OF KINDS OF MATERIALS TO THE SOIL AND TO THE WATER. ALL LIVING THINGS, REMEMBER, "COMBUST" FOOD -- THAT IS, THEY CARRY ON RESPIRATION. THE RED ARROWS FROM ALL LIFE FORMS SHOW THE RETURN OF A PRODUCT OF RESPIRATION, CO_2 OR CARBON DIOXIDE. RECALL THAT ONLY GREEN PLANTS CAN USE SUNLIGHT TO ASSEMBLE CARBON DIOXIDE AND WATER INTO CARBOHYDRATES. SIMPLE CARBOHYDRATES -- THE FIRST ORGANIC SUBSTANCES -- ARE REASSEMBLED WITH VARIOUS MINERALS TO FORM PLANT PROTEINS AND PLANT FATS OR LIPIDS. THESE, LIKE THE CARBOHYDRATES, ARE USED AS FOOD BY THE PLANTS THEMSELVES AND BY THE OMNIVORES, HERBIVORES, AND DECOMPOSERS. HAVE YOU THANKED A GREEN PLANT TODAY?

ARROWS SHOW THE CONTINUATION OF THE ORGANIC SUBSTANCES -- THE "FOOD" -- TO PLANT-EATING AND ANIMAL-EATING ANIMALS AND FINALLY TO DECOMPOSERS. I THINK YOU CAN VISUALIZE THE HEAVY DEPENDENCE OF ANIMALS ON THE PHOTOSYNTHETIC PROCESS CARRIED ON BY GREEN PLANTS. AGAIN YOU CAN SEE THAT THE DECOMPOSERS EVENTUALLY GET ALL THE ORGANIC MATERIAL -- THEY EVENTUALLY RECYCLE THE TISSUES OF BOTH PLANTS AND ANIMALS AS WELL AS THE WASTE MATERIALS OF ANIMALS.

ENERGY IS REQUIRED FOR THE MOVEMENT OF MATERIALS ILLUSTRATED IN THIS SLIDE. ENERGY IS NEEDED FOR GROWTH, TISSUE REPAIR, REPRODUCTION, AND IN THE CASE OF ANIMALS, ENERGY IS NEEDED FOR THE MOVEMENT NECESSARY TO GET TO THE MATERIALS THEY NEED TO EAT. THE NEXT DIAGRAM ILLUSTRATES THE ENERGY
*18 270 MOVEMENT.

YOU SHOULD NOTICE THAT THIS MOVEMENT IS NOT CYCLIC -- THE ARROWS SHOW THAT IT IS ONE DIRECTIONAL. THE RELATIVE SIZE OF THE ARROWS IN THIS SLIDE, DECREASING IN SIZE AS ONE GETS FURTHER FROM THE SUN, ILLUSTRATES THE LOSS OF ENERGY AT EACH STEP IN ENERGY TRANSFER. THIS ENERGY LOSS IS A NATURAL
275 PROCESS. TO BEGIN WITH, ONLY A SMALL PORTION OF THE SUN'S ENERGY IMPINGING ON GREEN PLANTS IS USEFUL IN PHOTOSYNTHESIS. SECONDLY, EACH LIVING ORGANISM IN THIS CHAIN OF ENERGY MOVEMENT USES MOST OF THE ENERGY IT OBTAINS IN ITS NORMAL BODY PROCESSES. AND THIRDLY, THE ENERGY TRANSFERS THAT TAKE PLACE WITHIN THE CELLS OF LIVING THINGS ALSO RESULT IN THE LOSS OF ENERGY -- MOST
280 OF THIS ENERGY ENDS UP AS HEAT ENERGY.

THE EFFICIENCY OF ENERGY TRANSFER FROM ORGANISM TO ORGANISM CONTINUES TO BE A TOPIC OF A LOT OF RESEARCH, BUT THE FIGURES SHOWN HERE ARE REASONABLE AVERAGES. ABOUT TEN PERCENT OF THE ENERGY IN THE TISSUE OF ONE ORGANISM CAN BE OBTAINED BY THE CONSUMER OR DECOMPOSER THAT USES THAT ORGANISM AS
285 FOOD. THE FIGURES IN THIS DIAGRAM WILL HELP YOU FOLLOW THIS ENERGY LOSS THROUGH THIS SIMPLIFIED FOOD WEB.

BECAUSE OF ENERGY "LOSS," THERE ARE LIMITS TO THE NUMBERS OF FOOD TRANSFERS THAT CAN OCCUR IN AN ECOSYSTEM. EACH SYSTEM NEEDS A CERTAIN NUMBER OF GREEN PLANTS TO SUPPORT THE OTHER MEMBERS OF THE SYSTEM. WHAT I AM SAYING
290 IS THAT THERE ARE LIMITS TO THE NUMBERS OF CONSUMERS THAT CAN BE KEPT ALIVE BY A CERTAIN NUMBER OF PRODUCERS.

THE MATERIAL MOVEMENT DIAGRAM IN THE LAST SLIDE AND THIS ENERGY MOVEMENT DIAGRAM ARE RATHER SIMPLE MODELS. WE KNOW THAT ALL PARTS OF ECOSYSTEMS ARE SOMEWHAT MORE COMPLICATED THAN THESE SIMPLE MODELS. WE ALSO KNOW THAT THE AVAILABILITY OF NEEDED MATERIALS, THE NATURAL RATES OF THE MOVEMENT OF THESE MATERIALS, AND THE EFFICIENCY OF ENERGY FLOW PLACE REAL LIMITS ON THE NUMBERS AND KINDS OF LIVING THINGS THAT MAINTAIN AN ECOSYSTEM AS A TRUE BALANCED WORKING SYSTEM.

WELL FUNCTIONING, WELL BALANCED ECOSYSTEMS ARE IN CONSTANT CHANGE. USUALLY THESE CHANGES OR ALTERATIONS ARE VERY SLOW. MANY OF THEM ARE QUITE SUBTLE -- PRETTY HARD TO DETECT. THE CHANGES RESULT IN THE INCREASE AND DECLINE OF SPECIES OVER PERIODS OF TIME. OVER LONG TIME PERIODS CHANGES RESULT IN THE DISAPPEARANCE AND APPEARANCE OF SPECIES. NOT ONLY DINOSAURS, BUT MANY SPECIES HAVE COME AND GONE OVER LONG PERIODS OF TIME.

*19 EVEN WITH THESE NORMAL CHANGES SOME FACTS SEEM CLEAR. ECOSYSTEMS THAT ARE RELATIVELY STABLE HAVE LARGE NUMBERS OF PRODUCERS, SMALLER NUMBERS OF HERBIVORES, AND EVEN SMALLER NUMBERS OF SECOND AND THIRD ORDER CONSUMERS. ECOLOGISTS USUALLY DESCRIBE THIS SITUATION WITH A PYRAMID SHAPED ILLUSTRATION SIMILAR TO THE ONE SHOWN HERE. AT MOST TIMES IN MOST ECOSYSTEMS THE QUANTITY OF ORGANISMS -- THAT IS THE "BIOMASS" OF EACH GROUP -- DECREASES AS ONE FOLLOWS MATERIAL AND ENERGY FLOW THROUGH THE SYSTEM. BOTH THE NUMBERS OF INDIVIDUALS IN EACH GROUP AND THE BIOMASS DECREASES IN MOST SYSTEMS. THERE ARE SOME EXCEPTIONS TO THIS GENERALIZED IDEA. IN SOME PONDS, FOR EXAMPLE, THERE ARE TIMES EACH YEAR WHEN THERE ARE HUGE NUMBERS OF ALGAE AND OTHER PRODUCERS, AND THEN DUE TO THE BRIEF LIFE SPAN OF ALGAE, THERE ARE TIMES WHEN THE CONSUMER POPULATIONS ARE MUCH LARGER THAN THE PRODUCER POPULATIONS THAT SUPPORT THEM. BUT EVEN IN PONDS OVER A PERIOD OF TIME, A MUCH LARGER NUMBER OF PRODUCERS MUST EXIST TO SUPPORT A SMALLER NUMBER OF CONSUMERS.

*20 DIVERSITY, VARIETY -- THESE ARE ALSO CHARACTERISTIC OF WELL FUNCTIONING
320 ECOSYSTEMS. ECOSYSTEMS THAT HAVE MANY DIFFERENT KINDS OF PLANTS AND KINDS
OF ANIMALS AND KINDS OR SPECIES OF MICROORGANISMS ARE USUALLY MORE EFFICIENT
ECOSYSTEMS. IN WELL BALANCED ECOSYSTEMS, EACH STEP IN THE PYRAMID IS
USUALLY OCCUPIED BY ORGANISMS THAT FUNCTION SLIGHTLY DIFFERENTLY. IN THE
PRODUCERS, FOR EXAMPLE, YOU HAVE DIFFERENT PRODUCERS THAT HAVE SLIGHTLY
325 DIFFERENT ROLES IN LIFE -- THEY HAVE SLIGHTLY DIFFERENT "NICHES." THE
DIFFERENT KINDS OF PRODUCERS LIVE IN DIFFERENT HABITATS. THEY GROW TO
DIFFERENT SIZES, THEY GROW AT DIFFERENT TIMES, AND THEY MAINTAIN DIFFERENT
LIFE CYCLES. DIFFERENT KINDS OF THINGS EAT THEM. THE DIFFERENT KINDS OF
CONSUMERS, LIKEWISE, HAVE A VARIETY OF DESIRED FOODS, A VARIETY OF WAYS
330 OF OBTAINING FOOD, AND A VARIETY OF KINDS OF MOVEMENT. THEY HAVE DIFFERENT
RANGES OF ACTIVITY, DIFFERENT IN TIME AND IN SPACE. THEY HAVE DIFFERENT
TEMPERATURE TOLERANCE RANGES, AND THEY DIFFER IN MANY, MANY OTHER WAYS.
FIGURE B IN THIS SLIDE ILLUSTRATES THE MORE STABLE ECOSYSTEM OF THE TWO.
THE GREATER NUMBERS OF KINDS OF ORGANISMS AND THE GREATER NUMBERS OF
335 INTERACTIONS PROVIDE SAFEGUARDS WHEN EVENTS DISTURB THE ECOSYSTEM. THESE
DISTURBING EVENTS CAN BE NATURAL CHANGES OR THEY CAN BE MAN-MADE CHANGES.
I WOULD LIKE TO POINT OUT AGAIN THAT MOST OF MAN'S DISRUPTIVE ACTIONS ON
NATURAL ECOSYSTEMS AND ALSO ON ECOSYSTEMS IN WHICH MAN IS VERY MUCH A PART
ARE THE RESULT OF OUR DECREASING THE VARIETY, DECREASING THE DIVERSITY,
340 OF THE SYSTEM.

*21 SHOWN HERE IS AN EXAMPLE OF ONE STAGE IN FOREST SUCCESSION. CAN YOU SEE
THE DIVERSITY IN THIS PICTURE? THERE IS QUITE A NUMBER OF DIFFERENT KINDS
OF PLANTS ILLUSTRATED HERE, AND EACH OF THE DIFFERENT PLANT SPECIES SUPPORTS
DIFFERENT KINDS OF ANIMAL SPECIES.

IN BOTH LAND AND WATER ECOSYSTEMS MANAGEMENT, WE HAVE TOO OFTEN MADE EFFORTS TO ELIMINATE ORGANISMS THAT WE CONSIDER TO BE "WEEDS" OR "PESTS." OUR DECISIONS TO ELIMINATE THESE ORGANISMS HAVE SELDOM CONSIDERED THE ROLES -- THE NICHES -- OF THESE ORGANISMS IN THE PROPER FUNCTIONING OF THE ECOSYSTEMS. SOMETIMES WE HAVE SIMPLY DISREGARDED THE ROLES, AND IN SOME CASES WE HAVE BEEN IGNORANT OF THE ROLES, THE INTERACTIONS, THAT THESE ORGANISMS PLAY IN THE PROPER FUNCTIONING OF THE ECOSYSTEM.

AGAIN, I WOULD LIKE THE DISCUSSION LEADER TO STOP THE AUDIO AND VISUAL PRESENTATION TEMPORARILY IN ORDER THAT YOU CAN DISCUSS SOME QUESTIONS. QUESTION ONE: WHAT IS THE BASIC DIFFERENCE BETWEEN THE WAYS THAT MATERIALS SUCH AS OXYGEN, CARBON DIOXIDE, MINERALS, AND WATER MOVE IN ECOSYSTEMS, AND THE WAY THAT ENERGY MOVES IN ECOSYSTEMS? QUESTION TWO: IN OUR OWN LIVING, WE PEOPLE FIND DIVERSITY OF EXPERIENCES IMPORTANT TO OUR LIVES. IN WELL FUNCTIONING ECOSYSTEMS VARIETY OR DIVERSITY ISN'T JUST A PLEASURABLE EXPERIENCE: IT'S ESSENTIAL TO THE FUNCTIONING OF THE SYSTEM. WHY IS VARIETY IN NUMBERS AND KINDS OF LIVING THINGS NECESSARY TO ECOSYSTEMS? QUESTION THREE: WHAT ARE SOME EXAMPLES OF THE WAYS THAT WE HAVE SIMPLIFIED ECOSYSTEMS AND ECOSYSTEM INTERACTIONS ON OUR AGRICULTURAL AND FOREST LANDS AND IN OUR OWN YARDS AND GARDENS? AND QUESTION FOUR: WHAT KINDS OF DIVERSITY OR VARIETY HAVE BEEN PLANNED INTO THE ENVIRONMENT OF OUR OWN CITIES, OR MIGHT BE PLANNED IN OUR CITIES, PLANNED IN SUCH AS WAY THAT OUR CITIES WOULD BE A MORE PLEASURABLE SYSTEM IN WHICH TO LIVE?

ANOTHER WAY WE HAVE OFTEN DISTURBED THE NATURAL WORKINGS OF ECOSYSTEMS IS BY CHANGING THE DYNAMICS OF ABIOTIC FACTORS -- THE NONLIVING THINGS. WE HAVE CHANGED MINERAL MATERIAL CYCLES IN MANY PARTS OF THE WORLD. FOR EXAMPLE,

*22 MOST OF OUR PROBLEMS WITH SURFACE WATER OF LAKES AND STREAMS AND PONDS AND SOME OF OUR PROBLEMS WITH OUR GROUND WATER ARE THE RESULT OF OUR INADVERTENTLY ADDING EXCESS NUTRIENTS -- MINERALS -- TO THE WATER. LARGE AMOUNTS OF NITROGEN AND PHOSPHOROUS COMPOUNDS IN THE FORM OF NITRATES AND PHOSPHATES MOSTLY HAVE BEEN ADDED TO MOST AQUATIC ECOSYSTEMS AS A RESULT OF OUR FAILURE TO REMOVE THE MATERIALS FROM OUR CITY AND INDUSTRIAL WASTES AND FROM OUR HEAVY RELIANCE ON FERTILIZERS. ONE RESULT OF THIS NUTRIENT OVERLOADING OF OUR WATERS IS THE FREQUENTLY OBSERVED EUTROPHICATION, OR OVER ENRICHMENT OF OUR WATERS. EUTROPHICATION OF PONDS AND LAKES IS A NATURAL PROCESS IN THE AGING OF THESE AQUATIC SYSTEMS. IT IS A PROCESS BY WHICH MANY PONDS AND LAKES NATURALLY BUT SLOWLY CHANGE FROM OPEN WATER ECOSYSTEMS TO MARSHES, SWAMPS, AND IN TIME TO LAND SYSTEMS. BUT THIS NATURAL CHANGE USUALLY TAKES PLACE OVER LONG PERIODS OF TIME, ON THE ORDER OF A FEW THOUSANDS OF YEARS FOR MANY SUCH SYSTEMS.

OUR NUTRIENT OVERLOADING OF AQUATIC ECOSYSTEMS RAPIDLY CHANGES THE POPULATION OF SOME ORGANISMS IN THESE SYSTEMS. MAN-MADE OR "CULTURAL" EUTROPHICATION IS USUALLY OBSERVED ON THE SURFACES OF PONDS AND LAKES IN THE FORM OF BLUE-GREEN ALGAE "BLOOMS" AND ALSO IN THE INCREASED NUMBERS *23 OF OTHER PLANTS ALONG SHORELINES. SOME COMMONLY OBSERVED EFFECTS ARE THE SMELLS PRODUCED BY THE DECAY OF ALGAE AND OTHER ORGANISMS AND BY THE INCREASE IN WATER TEMPERATURE. THERE ARE ALSO INCREASES IN FISH POPULATIONS RESULTING IN CULTURAL EUTROPHICATION.

RECALL THAT THE DECOMPOSERS REQUIRE OXYGEN, JUST AS OTHER FORMS OF LIFE REQUIRE OXYGEN. THE OVERLOADING OF NITROGEN AND PHOSPHOROUS-BEARING COMPOUNDS RESULT IN EXCESSIVE VEGETATION GROWTH WHICH IN TURN RESULTS IN INCREASED "FOOD" FOR DECOMPOSERS. DECOMPOSERS REACT TO THIS IMPROVEMENT AND BREAK DOWN THE ALGAE AND OTHER VEGETATION UNTIL THE BACTERIA RUN OUT

OF DISSOLVED OXYGEN. EVEN AT THIS POINT, SOME DECOMPOSING MICROBES -- THE ANAEROBIC BACTERIA -- CAN STILL CONTINUE TO FUNCTION. IN FACT, THE ANAEROBES FUNCTION BEST AT VERY LOW OXYGEN CONCENTRATIONS. THEIR WASTE PRODUCTS OFTEN RESULT IN EXCESSIVE AMOUNTS OF ODOROUS MATERIALS AND OTHER UNDESIRABLE PRODUCTS.

ALL OTHER AQUATIC ORGANISMS, FROM THE MANY MICROSCOPIC ANIMALS TO THE NUMEROUS INSECTS TO THE LARGER INVERTEBRATES SUCH AS CRAYFISH, AND EVENTUALLY TO THE VERTEBRATES -- THE FISH, THE BIRDS, AND THE MAMMALS, ALL OF THESE ARE EVENTUALLY EFFECTED BY THE CHANGES IN PONDS AND LAKES CAUSED BY CULTURAL EUTROPHICATION.

*24 LISTED HERE ARE THE BIOLOGICALLY IMPORTANT ELEMENTS THAT ARE IN GREATEST ABUNDANCE IN THE TISSUES OF LIVING ORGANISMS. MANY OTHER ELEMENTS INCLUDING POTASSIUM, SULFUR, SODIUM, IRON, MAGNESIUM, IODINE, CHLORINE ARE ALSO IMPORTANT BIOLOGICALLY. AND THERE ARE SOME WE CALL THE TRACE ELEMENTS WHICH, ALTHOUGH FOUND IN VERY, VERY, VERY SMALL AMOUNTS, ARE ABSOLUTELY ESSENTIAL TO THE GROWTH OF MANY PLANTS. THE ELEMENTS SHOWN HERE, HOWEVER, MAKE UP ABOUT 98 PERCENT OF THE ELEMENTS FOUND IN LIVING TISSUE. WITH THE EXCEPTION OF OXYGEN, FEW OF THE ELEMENTS ENTER ORGANISMS OR ARE USED BY ORGANISMS IN THEIR SIMPLE ELEMENTAL FORM. EVEN OXYGEN ENTERS AS A VERY TINY, TWO-ATOM MOLECULE. PLANTS AND ANIMALS TAKE IN OXYGEN AS "O_2," AS IT IS FOUND IN AIR AND AS IT IS FOUND DISSOLVED IN WATER. THE ELEMENTS NITROGEN AND PHOSPHOROUS, DESCRIBED AS NUTRIENTS A FEW MOMENTS AGO, ALSO ENTER LIVING THINGS IN MORE COMPLEX FORMS. NITROGEN USUALLY ENTERS IN THE OXIDATED FORM AS NITRATES (NO_3 MOLECULES), AND PHOSPHOROUS IN THE FORM OF VARIOUS PHOSPHATES (PO_3 MOLECULES). THERE IS MUCH VARIATION

IN THE CHEMICAL ABILITY OF DIFFERENT ORGANISMS TO USE THE DIFFERENT FORMS IN WHICH THESE IMPORTANT ELEMENTS OCCUR IN NATURE. NITROGEN, FOR EXAMPLE, MAKES UP ABOUT 78 PERCENT OF OUR AIR, BUT IT IS IN A VERY SIMPLE ELEMENTAL FORM -- A FORM THAT VERY FEW ORGANISMS, A FEW MICROBES, CAN USE. ALL LIFE, INCLUDING MAN, RELY ON SOME OF THESE ORGANISMS TO MAKE NITROGEN AVAILABLE TO US. NITROGEN, BY THE WAY, IS VERY NECESSARY TO THE PRODUCTION OF PROTEIN.

LEARNING ABOUT THE ROLES OF THESE ORGANISMS SUCH AS THESE NUTRIFYING BACTERIA AND OTHER ORGANISMS IS NOT ONLY INTERESTING BUT IT CAN PROVIDE EXTREMELY USEFUL INFORMATION FOR DECISIONS THAT AFFECT NATURAL AND MAN-MADE ENVIRONMENTS.

THERE ARE ALSO MANY OTHER AREAS OF ECOLOGICAL STUDY. INCLUDED IN ECOLOGICAL STUDY ARE SUCH THINGS AS POPULATION DYNAMICS. THIS IS THE STUDY OF THE FACTORS THAT CAUSE ANIMAL POPULATIONS TO INCREASE AND DECREASE OVER TIME. IN POPULATION DYNAMICS ARE SUCH THINGS AS COMPETITION BETWEEN INDIVIDUALS OF THE SAME SPECIES AND COMPETITION BETWEEN INDIVIDUALS OF DIFFERENT SPECIES, COMPETITION FOR AVAILABLE FOOD AND FOR SPACE, AND FOR TERRITORIES. ECOSYSTEMS HAVE LIMITS. THEY HAVE CARRYING CAPACITIES FOR ALL THE DIFFERENT KINDS OF PLANTS AND ANIMALS. IN THE HYPOTHETICAL GRAPH SHOWN HERE, IT APPEARS THAT SPECIES A HAS EXCEEDED ITS CARRYING CAPACITY AND IS HEADED FOR A POPULATION CRASH. THE CARRYING CAPACITY ITSELF, YOU MIGHT NOTE, HAS SUFFERED BY THE INCREASE IN POPULATION. THE STUDY OF THE SOCIAL BEHAVIORS OF ANIMALS IS ALSO A PART OF POPULATION DYNAMICS. I'M AFRAID TIME DOESN'T ALLOW US TO GET INTO THIS MOST INTERESTING ASPECT OF ECOLOGY. I SUGGEST THAT QUESTIONS ABOUT THE FACTORS THAT INFLUENCE POPULATION SIZES WOULD BE APPROPRIATE QUESTIONS FOR FURTHER POST PRESENTATION DISCUSSION.

BEST COPY AVAILABLE

ECOLOGICAL CONCEPTS

LISTED HERE ARE SELECTED BOOKS THAT CAN PROVIDE YOU WITH BOTH A REVIEW OF SOME ECOLOGICAL CONCEPTS, AND BOOKS THAT CAN ELUCIDATE MORE DETAILED ECOLOGICAL INFORMATION. LISTS OF THESE BOOKS WILL BE AVAILABLE TO YOU AT THE END OF THE PRESENTATION. THE BOOKS HAVE BEEN CHOSEN ON THE BASIS OF READABILITY, THEY ARE VERY READABLE, AND ON THE BASIS OF AVAILABILITY. MOST CAN BE FOUND AT MOST PUBLIC LIBRARIES.

IF YOUR TIME PERMITS NOW, I SUGGEST THAT THE DISCUSSION LEADER TEMPORARILY TURN OFF THE AUDIO AND VISUAL PORTIONS OF THE PRESENTATION TO DISCUSS THE FOLLOWING QUESTIONS. QUESTION ONE: I HAVE BRIEFLY DISCUSSED CULTURAL EUTROPHICATION. WHAT HAVE BEEN SOME OTHER EFFECTS OF MAN'S CHANGING MATERIAL MOVEMENT IN ECOSYSTEMS ON MAN'S ENVIRONMENT? QUESTION TWO: WHAT SORTS OF NATURAL PHENOMONA INFLUENCE POPULATION SIZES IN SYSTEMS? AND QUESTION THREE: WHAT ARE SOME WAYS IN WHICH WE CAN USE OUR KNOWLEDGE OF ECOSYSTEMS AND OUR SKILLS OF SYSTEMS ANALYSIS TO LOOK AT ENVIRONMENTAL PROBLEMS THAT AFFECT MAN AND PROBLEMS THAT AFFECT OTHER LIVING THINGS?

ENERGY

*1 THE SUBJECT OF THIS PRESENTATION IS ENERGY. THE CONTENTS COME FROM A VARIETY OF NEWS RELEASES, BOOKS, AND OTHER PUBLICATIONS, BOTH GOVERNMENTAL AND COMMERCIAL. PORTIONS COME FROM A PRESENTATION TO AN ENVIRONMENTAL EDUCATION WORKSHOP CONDUCTED BY DR. PAUL E. SAGER OF THE UNIVERSITY OF WISCONSIN AT GREEN BAY.

IF THE TOPIC WERE SPACE, AIR, OR WATER, OR SOME OTHER PHYSICAL NEED OF MAN AND OTHER LIVING THINGS, I COULD POINT OUT THAT THE EARTH SUPPLIES THESE THINGS, AND THAT THERE ARE PRETTY WELL DEFINED LIMITS TO THESE RESOURCES. THE EARTH DOES NOT ADD OR LOSE THOSE RESOURCES RAPIDLY. I COULD FURTHER POINT OUT THAT IF WE CONTINUE TO GROW, POPULATION-WISE, AND IF WE SUFFICIENTLY MISUSE OUR AIR, WATER, MINERALS, LIVING SPACE, AND OTHER RESOURCES, WE WILL HAVE SET A DEFINITE TIME LIMIT TO OUR EXISTENCE.

*2 BUT ENERGY AT FIRST GLANCE APPEARS TO BE DIFFERENT. ENERGY APPEARS TO BE RATHER UNLIMITED. EACH DAY THE SUN PROVIDES THE EARTH WITH ENERGY, MUCH MORE THAN IS USED BY PEOPLE OR OTHER LIVING THINGS. FOR EXAMPLE, ONLY ABOUT ONE PERCENT OF THE SUNLIGHT THAT FALLS ON A GREEN PLANT IS USED IN PHOTO-SYNTHESIS -- THE PROCESS THAT ULTIMATELY SUPPLIES US WITH ENERGY THROUGH THE FOOD WE EAT. NOTE THAT ON THIS DIAGRAM MAN GETS ABOUT ONE-TENTH OF THE SUN'S ENERGY IN THE SHORTER "MAN EATING PLANT" FOOD CHAIN. BUT WE GET ONLY ABOUT ONE ONE-HUNDREDTH OF THE ENERGY FROM THE LONGER "MAN EATING ANIMAL EATING PLANT" FOOD CHAIN. WHAT DOES THIS MEAN IN TERMS OF ENERGY EFFICIENCY IN FEEDING PEOPLE IN THE FUTURE?

BUT AS I SAID BEFORE, WE GET A NEW SUPPLY OF SUNLIGHT -- SUN ENERGY -- ON EARTH EACH DAY. BECAUSE OF THE INFLUENCE OF THIS SUNLIGHT ON AIR TEMPERATURE AND ON THE WATER CYCLE, WE HAVE THE ENERGY OF THE WIND AND THE ENERGY OF RUNNING WATER. WE ALSO HAVE THE GRAVITATIONAL INFLUENCE OF BOTH

THE SUN AND THE MOON ON THE EARTH, AND THIS PROVIDES US WITH THE ENERGY OF TIDES ON OUR SEA COASTS EACH DAY. THE PROBLEM WITH ENERGY IS THAT OUR LIFE STYLE REQUIRES ENERGY IN MANY FORMS -- MANY FORMS OTHER THAN THE HEAT THAT WE GET FROM SUNLIGHT AND THE FOOD ENERGY THAT RESULTS FROM PHOTOSYNTHESIS. UNLIKE OTHER LIVING THINGS, PEOPLE USE ENERGY TO EXTEND OUR DAY LENGTH; TO EXTRACT RESOURCES FROM THE EARTH; TO PUT THE RESOURCES TOGETHER INTO PRODUCTS WE NEED OR WANT; AND WE USE ENERGY TO TRANSPORT THE PRODUCTS TO US -- OR US TO THEM. ENERGY IS USED TO MAKE MANY OF THESE PROJECTS DO OTHER WORK FOR US. WE USE ENERGY TO ALLOW US TO LIVE IN AREAS WHERE THE CLIMATE WOULD OTHERWISE PREVENT US FROM LIVING, AND WE USE ENERGY TO STORE FOOD -- THE LIST COULD GO ON AND ON.

OVER TIME OUR DEMANDS FOR NEW KINDS AND GREATER AMOUNTS OF ENERGY HAVE *3 INCREASED TREMENDOUSLY. WE HAVE BEEN USING ENERGY SOURCES OTHER THAN THE SUN FOR HEAT AND FOOD SINCE WE HAVE LEARNED TO HANDLE FIRE. AS WE GOT SMARTER, WE DEVELOPED MORE NEEDS AND MORE WANTS. WE HARNESSED THE WIND. WE CAPTURED THE ENERGY OF RUNNING WATER AND USED SOME GEOTHERMAL SOURCES SUCH AS HOT SPRINGS FOR SOME OF OUR ENERGY. WE DISCOVERED THE POTENTIALS OF COAL, AND THEN OIL AND NATURAL GAS. AND WE LEARNED TO PRODUCE AND HANDLE ELECTRICITY. LATER WE LEARNED TO UNRAVEL THE SECRETS OF THE ATOM. WE HAVE USED ALL THIS KNOWLEDGE. WHEN IT COMES TO THE LAST SOURCE ON THE LIST, ATOMIC FISSION, WE CURRENTLY GET ABOUT ONE PERCENT OF OUR ELECTRICITY FROM ATOMIC FISSION -- THE PROCESS THAT POWERS NUCLEAR GENERATING PLANTS.

SO HERE WE ARE IN THE 20TH CENTURY. THE SUN IS STILL SHINING AND WE HAVE OUR KNOWLEDGE AND OUR TECHNOLOGICAL ACHIEVEMENTS, AND OUR DEMAND FOR ENERGY CONTINUES TO CLIMB. IT APPEARS TO BE CLIMBING FASTER THAN WE CAN SUPPLY IT. CONSUMER DEMAND FOR ELECTRICITY, FOR EXAMPLE, HAS INCREASED

ABOUT 145 TIMES PER PERSON SINCE THE YEAR 1900. OUR ELECTRICAL DEMANDS NOW DOUBLE ABOUT EVERY TEN YEARS.

YES, WE HAVE ENERGY PROBLEMS. WE HEAR ABOUT THEM DAILY AND NOW WE ARE STARTING TO REALIZE THAT OUR PROBLEMS HAVE BOTH NATIONAL AND INTERNATIONAL IMPLICATIONS. IT APPEARS THAT OUR ENERGY PROBLEM IS MOSTLY A PROBLEM OF PEOPLE NOT HAVING THE ENERGY THEY WANT -- OR THE THREAT OF THEIR NOT HAVING THE ENERGY THEY WANT. IT IS CLEAR THAT OUR NEEDS AND OUR WANTS AND OUR NUMBERS GREATLY INFLUENCE OUR ABILITY TO PROVIDE OURSELVES WITH THIS ENERGY. WHERE WE LIVE AS WELL AS HOW WE LIVE ALSO INFLUENCES THE AVAILABILITY OF ENERGY. TO SATISFY OUR WANTS, WE HAVE TO ASK QUESTIONS ABOUT PEOPLE WANTS AND NEEDS AND NUMBERS AND PEOPLE DISTRIBUTION, AND QUESTIONS ABOUT THE KINDS OF PRICES WE ARE WILLING TO PAY FOR ENERGY. LET'S TAKE A CLOSER LOOK AT SOME OF THE KINDS OF ENERGY SOURCES THAT WE NOW HAVE AVAILABLE AND LATER ON WE WILL CONSIDER SOME ENERGY SOURCES THAT WE MIGHT LOOK AT FOR THE FUTURE.

*4 IN 1972 THE UNITED STATES GEOLOGICAL SURVEY PUBLISHED A CIRCULAR ENTITLED "ENERGY RESOURCES OF THE UNITED STATES." THE BOOKLET IS MOSTLY ABOUT OUR RATHER "CONVENTIONAL" ENERGY SOURCES AND PREDICTIONS OF FUTURE SUPPLIES. IN THIS BOOK THEY INCLUDED SUCH SOURCES AS COAL, PETROLEUM LIQUIDS, NATURAL GAS, URANIUM, GEOTHERMAL ENERGY -- THAT IS, HEAT FROM THE EARTH -- AND THEY ALSO ADDED OIL SHALE RESOURCES. OIL SHALE IS AN OIL BEARING ROCK. THE AUTHORS OF THIS PUBLICATION, EVEN THOUGH THEY HAD THE EXPERT ADVICE OF MEMBERS OF ALL THE ENERGY INDUSTRIES, ACKNOWLEDGE THAT THERE IS A GREAT VARIANCE IN THE ACCURACY OF ESTIMATES OF ENERGY RESERVES FOR THIS COUNTRY. THEY OFFER THE FOLLOWING ESTIMATES.

THEY FELT THAT THE TOTAL COAL RESOURCE BASE IN THE UNITED STATES IS ABOUT 3,200 BILLION TONS. OF THIS AMOUNT, THEY THOUGHT THAT WE MIGHT BE ABLE TO IDENTIFY AND RECOVER ABOUT 6 TO 12 PERCENT.

THEY ESTIMATED THAT THE TOTAL BASE FOR PETROLEUM LIQUIDS TO BE ABOUT 2,900 BILLION BARRELS. OF THIS, THEY THINK WE CAN IDENTIFY AND RECOVER ABOUT TWO PERCENT. BY THE WAY, THE ESTIMATE WAS RECENTLY DROPPED TO ABOUT 45 1/2 BILLION BARRELS -- LESS THAN TWO PERCENT. BY THE WAY, INCLUDED ALSO IN THIS ESTIMATE IS ALL THE ALASKAN OIL, THE OIL OFFSHORE FROM ALASKA, THE OIL OFFSHORE FROM THE CONTINENTAL UNITED STATES, AND THE OIL ONSHORE IN THE LOWER 48 STATES.

THE TOTAL NATURAL GAS RESOURCE WAS ESTIMATED AT ABOUT 6,600 TRILLION CUBIC FEET. THEY THINK WE CAN RECOVER ABOUT 4 1/2 PERCENT OF THE NATURAL GAS RESERVE.

URANIUM RESOURCE DEPOSITS ARE ESTIMATED AT ABOUT 1,600 THOUSAND TONS OF URANIUM OXIDE. OF THIS, ABOUT ONE QUARTER OF A MILLION TONS ARE IDENTIFIED AS RECOVERABLE. THIS IS LESS THAN 15 PERCENT OF THE ESTIMATED URANIUM RESOURCES. INCLUDED IN THIS, BY THE WAY, ARE BOTH THE VERY RARE URANIUM 235 RESOURCES AND THE MUCH MORE ABUNDANT, BUT NOT IN NATURE FISSIONABLE, URANIUM 238 RESOURCES.

THEY WRITE THAT THE RESOURCES OF HEAT IN POTENTIAL GEOTHERMAL ENERGY ARE POORLY KNOWN. THE TOTAL RESOURCE BASE THEY DID ESTIMATE, THOUGH, AT GREATER THAN 10^{22} CALORIES, OF WHICH THEY FELT MAYBE 2.5×10^{18} CALORIES COULD BE CONSIDERED IDENTIFIABLE AND RECOVERABLE. THAT WOULD BE ABOUT 3/100 OF ONE PERCENT OF THE GEOTHERMAL RESOURCES.

THE OIL BEARING ROCK, OIL SHALE, IS ESTIMATED TO CONTAIN ABOUT 26 TRILLION BARRELS OF OIL, BUT NONE OF THAT RESOURCE THEY THINK WAS AVAILABLE

BECAUSE THE COST OF EXTRACTING THE OIL WAS TOO GREAT. THERE ARE OTHER COSTS TOO, SUCH AS THE COST OF THE GRAZING LAND THAT WOULD BE DESTROYED BY THE EXTRACTION OF THE OIL SHALE, THE COST OF DISPOSING OF MASSIVE AMOUNTS OF MINERAL SOLID WASTES THAT WOULD RESULT FROM THE EXTRACTION OF THE OIL SHALE. ALL OF THESE INFLUENCE THE FEASIBILITY OF TAKING OIL FROM OIL SHALE. THEY DID SUGGEST THOUGH THAT IF THE PRICE OF OIL INCREASED MODERATELY, SOMEWHERE BETWEEN 160 TO 600 BILLION BARRELS OF THIS OIL COULD BE SHIFTED INTO THE RECOVERABLE CATEGORY. IF THIS HAPPENS, THAT WOULD AMOUNT TO ABOUT 1 AND 1/2 PERCENT OF THE ESTIMATED RESOURCE.

NOW I WOULD LIKE TO REPEAT THAT ALL THESE FACTS AND FIGURES ARE ESTIMATES. THEY ARE GOOD ESTIMATES -- BUT THEY ARE ESTIMATES. THESE FACTS AND FIGURES ARE LIKEWISE NOT VERY EASY TO REMEMBER, BUT WE MIGHT BE ABLE TO PUT THEM IN A LITTLE BETTER PERSPECTIVE. ONE IDEA IS FAIRLY WELL ESTABLISHED -- THAT WE IN THE UNITED STATES HAVE A DEFINITE LIMIT TO THE KINDS OF ENERGY SOURCES DISCUSSED IN THAT U.S. GEOLOGICAL SURVEY REPORT. WHAT SORTS OF LIMITS ARE THERE ON THESE RESOURCES AND WHAT DO THEY MEAN? WELL, PREDICTIONS ON HOW LONG WE WILL HAVE SOME OF THESE MORE CONVENTIONAL SOURCES DOES VARY, BUT THE FIGURES SHOWN HERE REPRESENT A FAIRLY REASONABLE AVERAGE FROM THE VARIETY OF INFORMATION I HAVE HAD AVAILABLE.

MY FIRST REACTION TO THE FIGURES WITH THE EXCEPTION OF COAL RESERVES WAS "WOW, THEY SURE LOOK GRIM!" I STILL THINK THE FIGURES LOOK GRIM. COAL LOOKS MUCH BETTER THAN THE OTHERS, BUT KNOWING THAT SOME OF THIS COAL IS A VERY HIGH SULFUR CONTENT COAL, A COAL THAT CAN MAKE DANGEROUS SULFURIC ACID CONTRIBUTIONS TO OUR AIR FROM THE SULFUR DIOXIDE EMITTED WHEN IT IS BURNED, REMINDS ME THAT EVEN THIS RESOURCE IS GOING TO TAKE SOME SPECIAL HANDLING IF IT IS NOT GOING TO LEAD TO MORE ENVIRONMENTAL PROBLEMS.

WHAT ABOUT THE REST OF THE FIGURES? WELL, THEY MEAN THAT UNLESS WE START FINDING OR START USING OTHER GAS AND OIL RESOURCES OUR CURRENT RATE OF PETROLEUM CONSUMPTION IS NOT GOING TO CONTINUE VERY LONG. THEY ALSO MEAN THAT OUR PRESENT TYPES OF NUCLEAR FISSION POWER GENERATING PLANTS -- SOME OF THESE NUCLEAR PLANTS ARE BRAND NEW AND OTHERS ARE STILL ON THE DRAWING BOARDS -- BUT THESE WILL SOON BE OBSOLETE BECAUSE OF THE DEPLETION OF URANIUM 235 RESOURCES. THEY MEAN THAT THERE IS NO TIME LIKE RIGHT NOW TO START PLANNING FOR MORE EFFICIENT ENERGY CONSUMPTION AND FOR NEW ENERGY RESOURCES. SOME PLANNING HAS BEGUN.

WE DO KNOW MUCH OF THE TECHNOLOGY OF EXTRACTING SOME OF THE MORE SCARCE ENERGY SOURCES FROM SOME OF THE MORE ABUNDANT ONES. MAKING NATURAL GAS OUT OF COAL, FOR EXAMPLE, AND SQUEEZING PETROLEUM OUT OF OIL SHALE, FOR ANOTHER EXAMPLE. MORE RESEARCH IS NEEDED ON BOTH OF THESE PROCESSES TO MAKE THEM MORE ECONOMICALLY FEASIBLE. WE ALSO HAVE COME UP WITH SOME EXPENSIVE BUT OPERATIONAL METHODS OF CLEANING UP OUR HIGH SULFUR CONTENT COAL BEFORE IT IS USED AND OTHER METHODS OF SCRUBBING OUT A HIGH PERCENT OF THE SULFUR DIOXIDE AFTER THE COAL IS BURNED. A LARGE NUMBER OF OUR INDUSTRIES ACROSS THE NATION HAVE PUT A GREAT AMOUNT OF MONEY INTO THE PROCESSES ALREADY.

IN ADDITION, WE HAVE STARTED TO PLAN FOR A VARIETY OF NEW ENERGY SOURCES. PLANS FOR NEW SOURCES ARE ENCOURAGING BUT NOT EVERYTHING IS ROSEY. EACH ONE OF OUR NEW PROPOSED ENERGY SOURCES CAN, IF NOT CAREFULLY PLANNED, CREATE ADDITIONAL AND SERIOUS ENVIRONMENTAL PROBLEMS. I WILL GET TO BOTH THE PLANS AND THE PROBLEMS A LITTLE LATER IN THE DISCUSSION. RIGHT NOW I WOULD LIKE TO HAVE YOU CONSIDER ONE BIT OF PLANNING THAT MOST OF US HAVE FAILED TO DO.

ENERGY

MOST OF US HAVE FAILED TO CONSERVE THE ENERGY SOURCES WE CURRENTLY HAVE AVAILABLE. JUST HOW POOR HAS THIS NATION BEEN AT CONSERVING ENERGY?

* 7 WHEN IT COMES TO THE FOSSIL FUELS, COALS, PETROLEUM, NATURAL GAS, THE UNITED STATES HAS ABOUT 20 PERCENT OF THE WORLD'S SUPPLY. BUT WE CURRENTLY

160 CONSUME ABOUT 32 PERCENT -- SOME SAY MORE -- OF THE WORLD'S SUPPLY. NOW THAT MAY NOT SEEM LIKE WE ARE VERY WASTEFUL OR THAT WE NEED TO IMPORT VERY MUCH, BUT CONSIDER THE FACT THAT WE HAVE ONLY SIX PERCENT OF THE WORLD'S POPULATION. BY THE WAY, IT HAS BEEN PREDICTED THAT IN TEN YEARS WE, WITH SIX PERCENT OF THE WORLD'S POPULATION, MAY BE IMPORTING OVER 50 PERCENT OF

165 THE FOSSIL FUELS IN THE ENTIRE WORLD. I DON'T THINK THE REST OF THE WORLD IS GOING TO SIT BY AND LET US DO THIS VERY EASILY AT LEAST. WHAT DO YOU THINK? I THINK WE CAN AFFORD TO BE CONSERVATIVE IN OUR ENERGY CONSUMPTION. IF WE FAIL TO CONSERVE -- WISELY USE OUR ENERGY SOURCES, WHAT PRICES WILL WE HAVE TO PAY? WHAT PRICES IN TERMS OF WORLD TRADE? WHAT KINDS OF THINGS

170 WILL WE HAVE TO TRADE? WHAT PRICES IN TERMS OF WORLD IMAGE? I AM CONVINCED THAT WE ARE GOING TO HAVE TO BECOME MUCH MORE EFFICIENT IN OUR ENERGY USE. LET'S TAKE A LOOK AT WHERE OUR ENERGY IS CURRENTLY BEING USED.

* 8 WHO ARE THE LARGE CONSUMERS? THIS IS ONE WAY OF LOOKING AT THE QUESTION. INDUSTRY, AT 42 PERCENT OF THE END USES OF ENERGY, IS ON THE

175 TOP. WHO IS INDUSTRY? WELL, INDUSTRY PROVIDES US WITH JOBS, WITH THE VAST VARIETY OF PRODUCTS THAT WE NEED AND THE PRODUCTS THAT WE WANT. INDUSTRIES ALL OVER THE COUNTRY HAVE BEGUN TO RECOGNIZE THE NEED FOR EFFICIENT USE OF ENERGY WITHIN THEIR OPERATIONS. INDUSTRIES, JUST LIKE FARMERS, JUST LIKE BUSINESS PEOPLE AND HOMEMAKERS, ARE FEELING THE PINCH. MANY HAVE GONE

180 AS FAR AS TO CREATE NEW DEPARTMENTS FOR THE PURPOSE OF USING MORE WISELY THE

ENERGY SOURCES THEY HAVE AVAILABLE. UNION CARBIDE RECENTLY REPORTED 238 ENERGY CONSERVATION PROJECTS THAT NETTED THEM AN ANNUAL SAVINGS OF 6.15 MILLION DOLLARS IN ONE YEAR.

THE PAPER INDUSTRIES IN THIS COUNTRY HAVE BEEN WORKING ON INCREASED ENERGY EFFICIENCY. IN 1971 36 PERCENT OF THE PAPER INDUSTRIES' TOTAL ENERGY REQUIREMENTS FOR THEIR OPERATIONS CAME FROM THE BURNING OF A VARIETY OF THEIR OWN LIQUID AND SOLID WASTE MATERIALS. SOME OF THESE EFFORTS WERE SOMEWHAT FORCED BY HIGHER AIR AND WATER QUALITY STANDARDS, BUT THE EFFORTS WERE MADE. BY 1975 PAPER INDUSTRY PROCESSED WASTES MAY PROVIDE AS MUCH AS 39 PERCENT OF THEIR ENERGY NEEDS. BUT EVEN THOUGH THESE AND MANY OTHER INDUSTRIES ARE FINDING WAYS TO CONSERVE ENERGY, THEY KNOW THAT THEIR OWN ENERGY NEEDS CONTINUE TO RISE AND THAT THEY WILL HAVE TO CONTINUE TO LOOK FOR ADDITIONAL WAYS OF MEETING THESE NEEDS.

HOW ABOUT ENERGY CONSUMPTION FOR TRANSPORTATION OF PEOPLE AND FREIGHT? ALTHOUGH IT SEEMS TO HAVE HELD STEADY AT ABOUT 25 PERCENT OF OUR TOTAL ENERGY USE OVER THE LAST DECADE, IN ACTUAL AMOUNTS THE ENERGY REQUIREMENT FOR TRANSPORTATION HAS ALSO RISEN GREATLY. IS IT POSSIBLE THAT WE NEED WIDE SPREAD POLICIES OF MORE EFFICIENT ENERGY USE IN TRANSPORTATION OF PEOPLE AND MATERIALS. NOTE THAT RESIDENTIAL ENERGY NEEDS FOLLOW IN A CLOSE THIRD PLACE BEHIND TRANSPORTATION. WHAT ARE SOME OF THE HOME BEHAVIORS THAT COULD RESULT IN MORE EFFICIENT ENERGY USE? WE HAVE READ ABOUT MANY SUCH BEHAVIORS AND ADVERTISEMENTS RECENTLY. HOW MANY OF US HAVE TAKEN HEED OF THEM? HOW ABOUT WISE ENERGY USE IN OUR BUSINESS PLACES? IF YOU RUN A BUSINESS, YOU KNOW ABOUT THE ECONOMICS OF ENERGY. HAVE YOU AND YOUR EMPLOYEES LOOKED AT THE OTHER PRICES?

NOW I WOULD LIKE TO HAVE THE PRESENTATION LEADER TURN OFF THE AUDIO TAPE AND SLIDE PROJECTOR TEMPORARILY SO THAT YOU CAN DISCUSS THE FOLLOWING QUESTIONS. QUESTION ONE: WHAT SEEMS TO BE SOCIETY'S PROBLEMS WITH ENERGY AND ENERGY USE? QUESTION TWO: WHAT DO WE DO THAT CONTRIBUTES TO PROBLEMS IN ENERGY CONSUMPTION? AND QUESTION THREE: WHY DO WE DO THINGS THAT CONTRIBUTE TO PROBLEMS OF ENERGY USE?

* 9 I HOPE YOUR DISCUSSION WENT WELL. I WOULD LIKE TO TURN BACK BRIEFLY TO SOME QUESTIONS OF ENERGY USE IN TRANSPORTATION. MUCH OF OUR ENERGY PROBLEMS REVOLVE OUR TRANSPORTATION NEEDS AND WANTS, AND MANY ACCUSATIONS OF MAJOR CONBRIBUTIONS TO ENERGY PROBLEMS HAVE BEEN DIRECTED AT TRANSPORTATION INDUSTRIES, OIL COMPANIES, COMMERCE REGULATORY POLICIES AND AGENCIES, ROAD BUILDING AGENCIES, AND OTHERS INVOLVED IN THE MOVEMENT OF GOODS AND PEOPLE. THE RELATIVE EFFICIENCY IN TERMS OF ENERGY CONSUMPTION OF VARIOUS METHODS OF TRANSPORTATION ARE FAIRLY WELL DOCUMENTED. FOR EXAMPLE, WE KNOW THAT BUSES ARE MUCH MORE EFFICIENT THAN AUTOMOBILES FOR INNER CITY TRAVEL FOR PEOPLE. WE ALSO KNOW THAT, ENERGY-WISE, TRAINS ARE MUCH MORE EFFICIENT
* 10 FOR BETWEEN CITY MOVEMENT OF BOTH FREIGHT AND PEOPLE. TRAINS ARE MORE THAN FOUR TIMES MORE EFFICIENT THAN CARS, AND ALMOST TWICE AS EFFICIENT AS BUSES FOR TRANSPORTING PEOPLE BETWEEN CITIES. AS MOVERS OF FREIGHT, TRAINS ARE ABOUT 80 TIMES MORE EFFICIENT THAN AIR FRIEGHT AND ABOUT THREE TIMES MORE EFFICIENT THAN TRUCKS. MOST OF THE REST OF THE WORLD SEEMS TO RECOGNIZE THIS, BUT WHAT HAVE WE AMERICANS DONE TO OUR RAILROADS IN THIS CENTURY? IS IT TIME THAT WE TAKE A NEW LOOK AT THEM? WHAT ROLES CAN SUCH GOVERNMENTAL AGENCIES AS OUR INTERSTATE COMMERCE COMMISSION PLAY IN UPDATING ENERGY CONSERVATION IN TRANSPORTATION? ARE THERE POLICIES OTHER THAN TELLING US

TO DRIVE OUR CARS LESS OFTEN AND SLOWER THAT OIL COMPANIES CAN PROMOTE TO ADVANCE WISE ENERGY USE?

*11 PIPELINES ARE CURRENTLY OUR MOST EFFICIENT LAND TRANSPORTATION METHODS FOR SOME COMMODITIES. THEY ARE NOT WITHOUT PROBLEMS, BUT COULD WE MAKE MORE USE OF THEM IN THE MOVEMENT OF LIQUID AND GAS MATERIALS? IF WE FAIL TO PLAN FOR EFFICIENT USE OF SOME OF THESE COMMODITIES, OUR PIPELINES MIGHT BECOME OBSOLETE.

*12 NOW LET'S LOOK AT SOME POSSIBLE ENERGY SOURCES OF THE FUTURE. SOME ARE OLD AND SOME ARE RELATIVELY NEW. THESE AND OTHERS YOU WILL SEE IN LATER SLIDES ARE BEING GIVEN VARYING AMOUNTS OF CONSIDERATION AS FUTURE ENERGY SOURCES. EARLIER I MENTIONED THAT SOME INDUSTRIES HAVE BEGUN USING A VARIETY OF WASTE MATERIALS FOR FUEL TO GENERATE HEAT AND FOR OTHER USES. QUITE A NUMBER OF CITIES ARE ALSO EXPERIMENTING WITH THE IDEA OF USING COMMERCIAL AND MUNICIPAL WASTES AS FUEL FOR HEAT OR ELECTRICITY. SOME CITIES HAVE BEEN DOING THIS ON A LIMITED BASIS FOR MANY YEARS.

THE WIND IS ALSO BEING GIVEN NEW CONSIDERATION AS A MAJOR SOURCE OF

*13 ENERGY. MANY PEOPLE RELIED FOR MANY YEARS ON THIS TYPE OF WINDMILL FOR THEIR WATER SUPPLY. BY COMBINING WINDMILLS OF A DIFFERENT DESIGN WITH STORAGE BATTERIES IN AREAS OF REASONABLY CONSTANT WIND, SOME PEOPLE ARE NOW USING WIND-GENERATED ELECTRICITY IN THEIR HOMES. YOU CAN ACTUALLY PURCHASE YOUR OWN HOME MODEL OR PLANS FOR SUCH A MODEL NOW. OVER 50 YEARS AGO, BY THE WAY, DENMARK USED A FEW THOUSAND ELECTRICITY GENERATING WINDMILLS TO PROVIDE THEM WITH ELECTRICITY. THE IDEA IS NOT NEW BUT IT IS BEING GIVEN NEW CONSIDERATION.

*14 MANY INLAND PEOPLE IN THIS COUNTRY OBTAIN ELECTRICAL POWER FROM HYDRO-ELECTRIC POWER PLANTS. AGAIN, THE IDEA ISN'T NEW BUT SOME NEW CONSIDERATIONS

ARE BEING GIVEN TO USING THE DAILY WATER MOVEMENT OF TIDES AS SUCH AN ENERGY SOURCE. ONE SUCH OPERATION, PRODUCING ABOUT ONE QUARTER OF A MILLION KILOWATTS, IS CURRENTLY IN OPERATION ON THE COAST OF FRANCE. THERE ARE OTHER COASTLINES AROUND THE WORLD WHERE HYDROELECTRIC POWER USING TIDES MAY BE FOUND TO BE A FEASIBLE WAY OF GENERATING ELECTRICAL POWER.

*15 USING HEAT FROM THE INTERIOR OF THE EARTH IS NOT A NEW IDEA TO THE CITIZENS OF ICELAND, NEW ZEALAND, AND A FEW OTHER COUNTRIES. THERE ARE PLACES IN CALIFORNIA WHERE SOME SCIENTISTS THINK WATER HEATED IN DEEP WELLS COULD DRIVE ENOUGH TURBINES TO GENERATE SUFFICIENT ELECTRICITY THAT WOULD MEET ALL OR MOST OF CALIFORNIA'S CURRENT ELECTRICAL DEMANDS. AN AMOUNT EQUIVALENT TO ABOUT 40 PERCENT OF SAN FRANCISCO'S ELECTRICAL REQUIREMENTS ARE NOW BEING PRODUCED BY GEOTHERMAL ENERGY IN THE GEISER AREA OF SONOMA COUNTY IN CALIFORNIA. A NATIONAL SCIENCE FOUNDATION REPORT ESTIMATED THAT BY THE TURN OF THE CENTURY WE COULD PRODUCE THE EQUIVALENT OF ALL OF THE CURRENT UNITED STATES ELECTRICAL DEMANDS THROUGH GEOTHERMAL SOURCES. BUT ALL EXPERTS DO NOT AGREE. UNLESS WE PUT MORE RESEARCH AND DEVELOPMENT FUNDS INTO THE QUESTION OF FUTURE GEOTHERMAL ENERGY, WE WILL NEVER KNOW WHAT POTENTIAL IT DOES HAVE FOR US. WE NEED TO INVEST SOME OF OUR MONEY INTO THE QUESTION.

*16 COAL, OUR MOST ABUNDANT CONVENTIONAL ENERGY SOURCE IN THIS COUNTRY, COULD PROVIDE US WITH A VARIETY OF SYNTHETIC FUELS. ONE OF THEM IS A GAS SIMILAR TO NATURAL GAS, AND IT COULD BE USED IN THE SAME MANNER. COAL GASIFICATION TECHNOLOGY HAS COME A LONG WAY, BUT IT IS STILL A RELATIVELY EXPENSIVE PROCESS AND AS A NATION WE ARE NOT SPENDING MUCH MONEY LOOKING FOR MORE EFFICIENT GASIFICATION PROCESSES. COAL MINING, OF COURSE, POSES SOME SERIOUS PROBLEMS. MEMORIES OF THE MANY DEEP MINE DISASTERS AND MEMORIES

OF THE BLACK LUNG DISEASE PREVALENT IN DEEP MINES ARE SOME OF THE REASONS FEW PEOPLE ADVOCATE DEEP MINING OF COAL TODAY. STRIP MINING OF COAL ALSO HAS ITS PROBLEMS. EVIDENCE OF SUCCESSFUL RECLAMATION OF STRIP MINES IN THIS COUNTRY ARE ALL TOO RARE, BUT STRIP MINES CAN BE RECLAIMED. IN AN EXCELLENT ARTICLE ENTITLED "THE SEARCH FOR TOMORROW'S POWER," FOUND IN THE NOVEMBER 1972 NATIONAL GEOGRAPHIC, A SUCCESSFUL STRIP MINE RECLAMATION PROJECT IS DESCRIBED. IN A COAL REGION OF GERMANY, THE LARGE "BUCKET WHEEL EXCAVATOR," ABOUT 23 STORIES IN HEIGHT AND LONGER THAN TWO FOOTBALL FIELDS, WAS USED IN CONJUNCTION WITH ANOTHER MACHINE IN SUCH A WAY THAT CROPS COULD BE HARVESTED ON STRIP MINED LAND ONLY TWO YEARS AFTER THE COAL WAS REMOVED. SOME OF OUR ENERGY EXPERTS FEEL THAT COAL SHOULD OR MUST BE USED IN THIS COUNTRY. I SUGGEST THAT WE GIVE CAREFUL CONSIDERATION TO THE MANNER IN WHICH WE MINE OUR COAL.

*17 YOU KNOW THE PROBLEMS THIS NATION IS HAVING WITH LIQUID PETROLEUM RESOURCES. ANOTHER SOURCE OF LIQUID PETROLEUM DISCUSSED EARLIER WAS OIL SHALE. IT WAS ESTIMATED THAT TEN TIMES THE OIL OF OUR NORMAL DEPOSITS EXISTS IN THE OIL BEARING SHALES OF COLORADO, UTAH, WYOMING, AND SOME OF OUR OTHER WESTERN STATES. IT MAY TAKE ABOUT A TON OF ROCK TO PRODUCE 25 GALLONS OF OIL, AND THIS SOLID WASTE COULD MAKE OUR COAL STRIP MINE WASTES SEEM TRIVIAL. NONE OF OUR POTENTIAL ENERGY SOURCES ARE WITHOUT SERIOUS PROBLEMS, BUT MEETING ENERGY NEEDS FOR THE FUTURE IS ITSELF SERIOUS BUSINESS.

*18 HERE ARE THREE MORE POSSIBLE ENERGY SOURCES OF THE FUTURE. NUCLEAR FISSION -- OR ATOM SPLITTING -- IS CURRENTLY PRODUCING A SMALL PERCENT, ABOUT ONE PERCENT, OF OUR ELECTRICITY. BUT THE KIND OF URANIUM -- URANIUM 235 THAT POWERS THE PROCESS IS QUITE RARE AND ACCORDING TO MOST ESTIMATES, WON'T BE AVAILABLE IN TWO OR THREE DECADES -- TWENTY OR THIRTY YEARS.

ENERGY

*19 THIS NUCLEAR POWER ELECTRICITY GENERATING PLANT AND OTHERS CURRENTLY
310 IN OPERATION AND MANY OTHERS ON THE DRAWING BOARDS ARE NOT BUILT TO HANDLE THE MORE ABUNDANT ISOTOPE OR URANIUM -- URANIUM 238. SOME PEOPLE THINK THAT THE ELECTRICITY OF THE FUTURE WILL COME FROM A REACTOR WHICH USES THE 238, A REACTOR CALLED THE FAST BREEDER NUCLEAR REACTOR. IN THE FAST BREEDER REACTOR THE NOT NORMALLY FISSIONABLE 238 WOULD BE PLACED AROUND
315 A CORE OF THE RADIOACTIVE URANIUM 235. BY A CHAIN REACTION, PARTS OF THE FISSIONABLE U235 WOULD CHANGE THE U238 INTO RADIOACTIVE PLUTONIUM. THIS WOULD PRODUCE OR "BREED" NEW RADIOACTIVE MATERIALS -- MATERIALS THAT COULD BE USED AS AN ENERGY SOURCE. THIS "BREEDING" OF PLUTONIUM AND OTHER RADIOACTIVE ISOTOPES WOULD PROVIDE THE FUEL TO GENERATE ELECTRICITY
320 IN OTHER BREEDER REACTORS. BUT NUCLEAR FISSION OF THE FAST BREEDER TYPE HAS VERY SERIOUS DRAWBACKS. THIS TYPE OF FISSION PRODUCES OR BREEDS A MASSIVE AMOUNT OF RADIOACTIVE WASTE MATERIALS. MUCH MORE RADIOACTIVE MATERIALS THAN WE CAN PUT TO USE. ONE MUST ASK THE QUESTION -- <u>WHERE</u> AND <u>HOW</u> CAN WE SAFELY STORE LARGE AMOUNTS OF RADIOACTIVE MATERIALS, MANY OF THE
325 THEM REQUIRING STORAGE REMOTE FROM PEOPLE, STORAGE FOR THOUSANDS OF YEARS? BECAUSE THESE HIGHLY RADIOACTIVE FISSION BY-PRODUCTS ARE EXTREMELY DIFFICULT TO STORE, SHOULD WE BE PUTTING OUR EFFORTS INTO OTHER FUELS OF THE FUTURE, SAFER FUELS? AND THERE ARE SAFER FUELS. THERE ARE EVEN SAFER NUCLEAR FUELS.

330 ON THE PREVIOUS SLIDE NUCLEAR FUSION WAS LISTED. CONTROLLED NUCLEAR FUSION, NOT FISSION, NOT SPLITTING, BUT FUSION, PUTTING ATOMS TOGETHER, IS BELIEVED BY MANY TO BE A MUCH MORE REALISTIC NUCLEAR POWER SOURCE FOR THE FUTURE. NUCLEAR FUSION, THE PROCESS BY WHICH THE SUN AND THE OTHER STARS PRODUCE LIGHT, REQUIRES A FORM OF HEAVY HYDROGEN FOR FUEL.

IT PRODUCES A FORM OF HELIUM WHEN THE HYDROGEN ATOMS ARE FUSED TOGETHER. VERY LITTLE DANGEROUS RADIOACTIVITY RESULTS FROM CONTROLLED FUSION. OUR SEAWATER HAS A VERY ABUNDANT SUPPLY OF THE NECESSARY HEAVY HYDROGEN THAT WOULD SERVE AS A FUEL. THE PROBLEM IS THAT CONTROLLED NUCLEAR FUSION, UNLIKE UNCONTROLLED FUSION AS IN THE HYDROGEN BOMB, REQUIRES THAT THE FUEL BE HEATED TO TEMPERATURES OF SOME HUNDRED MILLION DEGREES. CURRENTLY WE ARE NOT PUTTING MUCH RESEARCH INTO THE PROCESS OF HEATING THE HEAVY HYDROGEN. UNLESS WE DEVOTE MORE RESEARCH AND DEVELOPMENT MONIES TO THIS PROCESS, WE MAY AGAIN NOT EVER KNOW THE POTENTIAL OF NUCLEAR FUSION AS A MAJOR ELECTRICITY GENERATING PROCESS. WE HAVE MASTERED THE FUSION TECHNIQUES OF HYDROGEN BOMB BUILDING. BEFORE WE CAN HAVE FUSION FOR ELECTRICITY, WE WILL HAVE TO MASTER THE TECHNIQUES OF CONTROLLED NUCLEAR FUSION.

A FEW RESEARCH EFFORTS ARE BEING MADE. ONE OF THEM INVOLVES A PROCESS CALLED LAZER BOMBARDMENT. ANOTHER ONE CALLED MAGNETIC SQUEEZE IS BEING LOOKED AT AS A PROCESS BY WHICH WE CAN DEVELOP CONTROLLED FUSION. BUT RESEARCH AND DEVELOPMENT FOR NUCLEAR ENERGY ARE NOT GENERALLY GOING INTO FUSION, BUT RATHER THEY ARE GOING INTO THE FAST BREEDER REACTOR, THE PROCESS BY WHICH LARGE AMOUNTS OF VERY RADIOACTIVE MATERIALS ARE PRODUCED IN LARGE QUANTITIES.

PLEASE TURN THE TAPE TO THE OTHER SIDE FOR THE REMAINDER OF THE PRESENTATION.

AN ENTIRELY DIFFERENT FUEL FOR THE FUTURE MAY BE FOUND IN NORMAL HYDROGEN. LIQUID HYDROGEN HAS BEEN USED AS A SPACE-AGE FUEL. IT HAS BEEN USED TO HELP SEND MEN TO THE MOON. IT COULD BE USED TO HEAT HOMES, POWER AUTOMOBILES, OR GENERATE ELECTRICITY -- WITH WATER AS ITS ONLY

MAJOR WASTE PRODUCT. NORMAL HYDROGEN FOUND IN WATER AS A PART OF THE WATER MOLECULE IS ABOUT THE MOST ABUNDANT ELEMENT IN THE UNIVERSE, AND IT CAN BE PRODUCED BY ELECTROLYSIS. THIS IS A PROCESS THAT GOES ON IN HIGH SCHOOL LABORATORIES. THIS IS A PROCESS OF ELECTRONICALLY BREAKING OR SPLITTING WATER MOLECULES. THE PROBLEM WITH HYDROGEN AS A FUEL OF THE FUTURE LIES IN COST. OUR CONVENTIONAL ELECTROLYSIS PROCESSES ARE BELIEVED BY MANY TO BE TOO EXPENSIVE TO BE CARRIED OUT ON THE LARGE SCALE NECESSARY TO MAKE THIS A PROCESS BY WHICH WE COULD GAIN ANY LARGE AMOUNTS OF POWER. NOT EVERYBODY AGREES. RESEARCH AND DEVELOPMENT FOR EFFICIENT ELECTROLYSIS PROCESSES ARE BEING DONE IN OTHER COUNTRIES. IN THE EUROPEAN COMMON MARKET, EURATOM RESEARCH CENTER IN ITALY, FOR EXAMPLE, RESEARCH IS BEGINNING TO BRING DOWN THE COST OF SPLITTING THE HYDROGEN FROM WATER. ONE LEADER IN THIS RESEARCH TEAM REPORTS THAT WE MIGHT HAVE CHEAP HYDROGEN BY THE YEAR 1982. IS IT TIME FOR AMERICANS TO LOOK TO OTHER COUNTRIES FOR SOME TECHNICAL ASSISTANCE?

*20 SOME NEW AND RENEWED EXPERIMENTS ARE BEING PERFORMED ON THESE THREE POSSIBLE ENERGY SOURCES OF THE FUTURE. SOME PEOPLE ARE WORKING WITH BANKS OF MIRRORS IN EFFORTS TO FOCUS AND CONCENTRATE SUNLIGHT FOR HEAT PRODUCTION -- WHICH IN TURN COULD BE USED TO GENERATE ELECTRICITY. OTHERS ARE EXPERIMENTING WITH GLASS PIPES AND STEEL TUBES FULL OF CIRCULATING GASES IN EFFORTS TO STORE DAYTIME SUNLIGHT FOR NIGHTTIME HEAT. WE ARE ALREADY CONVERTING SUNLIGHT TO ELECTRICAL POWER BY MEANS OF SOLAR CELLS ON OUR SPACE SATELLITES. THESE ARE CURRENTLY FAIRLY EXPENSIVE GADGETS, BUT ONE GROUP OF RESEARCHERS ARE WORKING ON DEVELOPING CHEAPER SOLAR CELLS, AND THEY ARE ALSO WORKING ON IDEAS FOR SHUTTLING BANKS OF SOLAR CELLS FROM SPACE BACK TO EARTH FOR USE ON EARTH.

ENERGY

A NUMBER OF FUEL CELLS THAT CONVERT CHEMICAL ENERGY INTO ELECTRICAL ENERGY ARE ALSO BEING DEVELOPED. THE APOLLO SPACECRAFT FUEL CELLS, WHICH CONVERT HYDROGEN AND OXYGEN INTO WATER AND THEN INTO ELECTRICITY, ARE CURRENTLY GETTING SOME ATTENTION.

THE LAST, BUT NOT THE LEAST IN TERMS OF THE SIZE OF ITS NAME, IS MAGNETOHYDRODYNAMICS -- OR MHD FOR SHORT. IN THIS PROCESS, MOST ANY FOSSIL FUEL CAN BE USED TO PRODUCE ELECTRICITY FAIRLY EFFICIENTLY. THE FOSSIL FUEL IS BURNED TO FORM A FLAME THAT IS SEEDED WITH POTASSIUM SALT TO INCREASE ITS CONDUCTIVITY AND THE FLAME IS THEN SQUIRTED AT SUPERSONIC SPEED THROUGH SOME ELECTROMAGNETS. THE MOVEMENT PRODUCES ELECTRICITY. THE NICE FEATURE OF THIS SYSTEM IS THAT THE PROCESSS MAY BE ABLE TO REACH A 60 PERCENT EFFICIENCY IN ELECTRICAL PRODUCTION. THIS EFFICIENCY IS ABOUT ONE AND ONE-HALF TIMES THAT OF OUR CURRENT FOSSIL FUEL GENERATING PLANTS. AFTER VIEWING AN EARLY MODEL AT THE AVCO EVERETT RESEARCH LAB IN MASSACHUSETTS, A GROUP OF RUSSIAN SCIENTISTS DEVELOPED A WORKING MHD GENERATOR THAT MAY SOON BE DELIVERING ELECTRICITY TO MOSCOW. THE EFFICIENCIES POSSIBLE WITH MHD GENERATORS MAY HELP RELIEVE OUR ENERGY PROBLEM, BUT KEEP IN MIND THAT THE MHD PROCESS REQUIRES FOSSIL FUELS AND ALL OF THE PROBLEMS AND PRICES THAT ARE INHERENT IN THE USE OF FOSSIL FUELS ARE THEREFORE A PART OF THE PROBLEMS AND PRICES OF THE MHD OPERATION.

*21 MANY QUESTIONS NEED TO BE RAISED AND ANSWERED. DO WE NEED ENERGY? OF COURSE, WE NEED ENERGY. WILL WE NEED NEW SOURCES? CERTAINLY WE WILL. WILL WE NEED MORE EFFICIENT USE OF ENERGY? MOST ASSUREDLY WE MUST BE MORE EFFICIENT IN OUR USE OF ENERGY. WE CAN'T AFFORD TO LOOK AHEAD WITHOUT REMEMBERING THE ENVIRONMENTAL MISTAKES WE HAVE MADE IN ENERGY PRODUCTION IN THE PAST. WE CANNOT AFFORD NEW AND CHEAP ENERGY SOURCES

AT JUST ANY PRICE. THERE WILL BE PRICES -- MANY KINDS OF PRICES -- AND WE WILL HAVE TO DECIDE WHICH ONES ARE WORTH PAYING. THERE ARE, I BELIEVE, SOME PRICES THAT ARE NOT WORTH PAYING FOR THE KINDS OF ELECTRICAL POWER AND THE AMOUNTS THAT WE WANT.

LET'S TAKE A BREAK IN A MOMENT TO GIVE YOU A CHANCE TO DISCUSS THE FOLLOWING QUESTIONS. QUESTION ONE: HOW SERIOUS ARE OUR PROBLEMS WITH OLD AND NEW ENERGY SOURCES? QUESTION TWO: HOW MUCH OF WHAT KINDS OF PROBLEMS CAN WE TOLERATE? AND THREE: WHAT MIGHT BE THE RESULTS OF OUR TOLERANCE OF ENERGY ASSOCIATED PROBLEMS ON FUTURE GENERATIONS?

I HOPE THIS DISCUSSION WENT WELL. THERE ARE SOME SERIOUS QUESTIONS THAT MUST BE ANSWERED IF WE ARE TO KNOW WHAT KINDS OF FUTURE ENERGY SOURCES * 22 ARE WORTH PURSUING. SERIOUS QUESTIONS HAVE TO BE RAISED ABOUT HUMAN BEHAVIOR. ALL OF US HAVE TO TAKE A GOOD LOOK AT OUR OWN PERSONAL CONTRIBUTIONS TO OUR ENERGY PROBLEM.

* 23 IN THE PAST WE HAVE ASKED FOR ALL KINDS OF CONVENIENCES. SCIENCE, TECHNOLOGY, INDUSTRY, AND COMMERCE HAVE RESPONDED. POWER COMPANIES HAVE MADE AN EFFORT TO PROVIDE PLENTY OF CHEAP ELECTRICITY -- AND IN THE PAST * 24 THEY HAVE ASKED US TO ASK FOR MORE. WE OBLIGED THEM AND NOW WE HAVE AN ARRAY OF ELECTRICAL GADGETS -- SOME POSSIBLY NECESSARY BUT MANY OF * 25 QUESTIONABLE NEED. WHO NEEDS AN AIR CONDITIONER? DARN NEAR ALL OF US THINK WE DO. WE THINK WE NEED THEM IN OUR HOMES, OFFICES, SCHOOLS, IN OUR CARS, AND SOME EVEN HAVE THEM IN THEIR CAMPING EQUIPMENT. TODAY WE FIND PRACTICALLY ALL NEW OFFICE BUILDINGS, SHOPPING CENTERS, AND HOMES DESIGNED IN SUCH A WAY THAT AIR CONDITIONING IS REQUIRED. WHO WANTS TO LOOK OUT AT WHAT WE HAVE DONE TO OUR CITIES? WHO NEEDS WINDOWS? WHO CAN SURVIVE THE AIR POLLUTION OF PARTS OF MOST OF OUR CITIES? WHO WOULD

OPEN WINDOWS IF WE HAD THEM? WE ARE DESIGNING OUR LIVES SO THAT IT LOOKS LIKE WE NEED AIR CONDITIONING. HUMAN BEHAVIOR? POOR PLANNING!

*26 FOR THOSE WHO WANT THE BEST LOOKING LAWN IN THE NEIGHBORHOOD WITH THE LEAST EFFORT, HERE IS A GADGET THAT YOU CAN SHOW YOUR FRIENDS. HOW DID

*27 THE LENGTH AND THE COLOR OF GRASS BECOME A STATUS SYMBOL ANYWAY? MOST PEOPLE DO NOT REQUIRE OR AT LEAST DO NOT THINK THEY REQUIRE OR POSSIBLY CANNOT AFFORD THE RIDING VARIETY OF LAWN MOWER. ONE OF THE GAS OR ELECTRIC MODELS WILL DO THE JOB AND REQUIRES LESS STORAGE SPACE. BUT LOOK CLOSELY AND IN THE BACKGROUND YOU WILL SEE A PAIR OF LAWN MOWERS THAT NOT ONLY DO NOT REQUIRE PETRO, BUT THEY ALSO DO NOT AWAKEN YOUR NEIGHBOR EARLY IN THE MORNING OR DISTURB THE NEIGHBOR'S CHILDREN SLEEPING ON A SUMMER EVENING. THEY ALSO ARE NOT VERY CONVENIENT -- BECAUSE MOST OF US WOULD RATHER FIND MORE EXCITING WAYS TO GET OUT NEEDED RECREATION AND EXERCISE.

MY POINT IS THAT WE ARE GOING TO HAVE TO START ASKING SERIOUS QUESTIONS

*28 ABOUT OUR PERSONAL CONTRIBUTIONS TO ENERGY PROBLEMS. ENERGY PROBLEMS ARE SERIOUS. IF WE FAIL TO LOOK AHEAD, HOW LONG WILL WE BE ABLE TO AFFORD SUCH SIMPLE AMENITIES OF LIFE AS THE PLEASURE OF SITTING IN FRONG OF A REAL FIREPLACE BURNING REAL WOOD? WILL WE SUFFICIENTLY DEPLETE OUR WOODLANDS SO THAT WE CANNOT AFFORD TO BUY FIRE WOOD? WILL WE SUFFICIENTLY FOUL OUR AIR TO THE POINT THAT THE ADDITION OF FIREPLACE SMOKE CONSTITUTES A HEALTH HAZARD AND BECOMES ILLEGAL? OR WILL WE BE USING FIREPLACES FOR HEATING OUR HOMES AND FOR FREPARING OUR FOOD?

*29 EACH ONE OF US MUST SOON GIVE SERIOUS THOUGHT TO THESE KINDS OF QUESTIONS. WE NEED TO ASK ABOUT THE IMPACT OF OUR NEEDS AND WANTS ON OUR ENVIRONMENT. WE MAY FIND THAT IF WE FAIL TO ASK QUESTIONS SOMEONE ELSE MAY TAKE AWAY OUR OPTIONS TO ASK.

ENERGY

430 465 WE NEED ENERGY. ENERGY HERE IS SYMBOLIZED BY THE POWERPLANT IN THE BACKGROUND ON THE PICTURE. I THINK WE ALSO NEED MANY OTHER THINGS FOR A RICH MEANINGFUL LIFE. FOR HIGH QUALITY LIVING MANY FEEL THAT WE NEED THE THINGS SYMBOLIZED BY THE STAND OF CATTAILS IN THE FOREGROUND OF THIS PICTURE. WHAT DO YOU THINK? I THINK WE NEED THEM BOTH.

BEST COPY AVAILABLE

THE SUBJECT OF THIS PRESENTATION IS SOLID WASTE MANAGEMENT. PORTIONS OF THE PRESENTATION ARE FROM A DISCUSSION CONDUCTED BY MR. ROBERT GRISEMER, OF CONTINENTAL CAN COMPANY, INC. OF CHICAGO, ILLINOIS, AND DR. HAROLD J. DAY, OF THE UNIVERSITY OF WISCONSIN AT GREEN BAY. SOME PARTS ARE FROM THE EDUCATIONAL MATERIALS AVAILABLE FROM THE WOMEN'S CLUB SERVICE BUREAU, WITH NATIONAL OFFICES IN NEW YORK CITY.

WHAT IS SOLID WASTE?

*2 IN A BOOKLET ENTITLED "THE TRUTH ABOUT TRASH," THE QUESTION, "WHAT IS SOLID WASTE?," IS ANSWERED IN THIS MANNER. ACCORDING TO FEDERAL DEFINITION, SOLID WASTE IS; "GARBAGE, REFUSE, AND OTHER DISCARDED MATERIALS FROM INDUSTRIAL, COMMERCIAL, AGRICULTURAL, AND COMMUNITY ACTIVITIES. THIS EMBRACES THE FAMILIAR TRASH CAN ITEMS, FOOD SCRAPS AND DISCARDED PACKAGING, AS WELL AS LARGE ITEMS SUCH AS JUNKED FURNITURE AND ABANDONED AUTOS. SUCH MUNICIPAL WASTE, AS IT IS CALLED, CONTAINS METAL, WOOD, PAPER, PLASTICS, GLASS, AND A VARIETY OF ORGANIC COMPOUNDS, MANY WITH POTENTIAL RECYCLING VALUE."

*3 WHAT IS THIS SOLID WASTE LIKE? WHERE DOES IT COME FROM? WELL, IT COMES FROM MANY PLACES AND IN MANY FORMS. THE SOLID WASTES FROM OUR HOMES, AS REPORTED IN THE 1969 BUREAU OF SOLID WASTE MANAGEMENT STUDY, LISTS PAPER PRODUCTS AT ABOUT 44% BY WEIGHT AS THE LARGEST COMPONENT OF HOME SOLID WASTE MATERIALS. FOOD WASTES ARE LISTED AT 18.2%, METALS AT A LITTLE OVER 9%, AND GLASS AND CERAMICS FOLLOW AT CLOSE TO 9%. A MORE RECENT

*4 SURVEY REPORTS SIMILAR BUT SLIGHTLY DIFFERENT RESULTS. HOUSEHOLD REFUSE IN THE FORM PAPER PRODUCTS STILL RANKED NUMBER ONE IN THIS SURVEY BUT IT WAS FOUND TO BE ABOUT 10% LOWER. ORGANIC GARBAGE REMAINED IN SECOND PLACE BUT IT ALSO DROPPED ABOUT 10%. THIS SURVEY SHOWED THAT METALS IN HOUSEHOLD

SOLID WASTES WERE UP ABOUT 10% AND PLASTICS INCREASED ABOUT 9% OR 10% FROM THE EARLIER STUDY. OTHER SURVEYS, OF COURSE, WILL SHOW VARYING PERCENTAGES, BUT IT'S OBVIOUS THAT PAPER, ORGANIC MATERIAL, METALS, AND GLASS MAKE UP A LARGE PROPORTION OF OUR HOUSEHOLD SOLID WASTE MATERIALS. I EXPECT THAT THE INCREASE IN PLASTICS REFLECTED IN THE LATTER SURVEY WILL CONTINUE AS TIME GOES ON.

*5 THERE ARE MANY KINDS OF SOLID WASTES THAT DON'T FALL IN THE CATEGORIES OF HOUSEHOLD GARBAGE. LITTER IS ONE KIND. LITTER IN OUR CITIES, SUBURBS, AND ACROSS OUR COUNTRYSIDE IS NOT ONLY VISUAL POLLUTION, BUT IT'S ALSO AN ECONOMIC HEADACHE. EACH YEAR WE DEVOTE MILLIONS OF TAX DOLLARS TO TAKING CARE OF OUR HOME SOLID WASTES, BUT WE ALSO DEVOTE MILLIONS OF TAX DOLLARS TO PICKING UP ROADSIDE, STREET, AND PARK LITTER. TOO MANY OF US STILL HAVE THE BAD HABIT OF USING THE EARTH AS A LARGE GARBAGE CAN.

SOME OF OUR LITTER CAN'T BE DUMPED IN A GARBAGE CAN OR IN AN ASHTRAY OR A WASTEBASKET. SOME OF OUR GREATEST EYESORES, GREATEST IN TERMS OF SIZE,

*6 ARE ABANDONED AUTOS. BY SOME ESTIMATES, WE RETIRE MORE THAN 9 MILLION CARS EACH YEAR IN THIS COUNTRY. THE SAME ESTIMATES SAY THAT ONE AND ONE-HALF MILLION OF THESE CARS ARE ABANDONED ON OUR COUNTRYSIDES AND IN OUR CITIES. NEW YORK CITY ALONE, FOR EXAMPLE, HAD 57,000 ABANDONED CARS ON ITS STREETS BACK IN 1969.

NO ONE KNOWS HOW MANY REFRIGERATORS, WASHING MACHINES, AND SIMILAR SIZE CASTOFFS ARE JUNKED BESIDE OUR ROADS AND IN OUR VACANT LOTS AND FIELDS, BUT WE DO KNOW THAT IT DOESN'T TAKE VERY MANY OF THEM TOSSED IN A DITCH SOMEWHERE TO PROMOTE THE DEVELOPMENT OF A DUMPING SITE FOR OTHER PEOPLE.

OTHER KINDS OF SOLID WASTES AREN'T LARGE IN SIZE, BUT THEY POSE LARGE PROBLEMS BECAUSE OF THEIR HAZARDOUS PROPERTIES. RADIOACTIVE WASTE
*7 MATERIALS FROM INDUSTRY, POWER PRODUCTION, MEDICAL RESEARCH, AND OTHER RESEARCH DON'T TAKE MUCH SPACE AND DON'T CREATE VISUAL POLLUTION, BUT RADIOACTIVE WASTES REQUIRE STORAGE FACILITIES THAT MUST REMAIN SECURE AND FAR AWAY FROM PEOPLE FOR LONG PERIODS OF TIME -- SOME FOR THOUSANDS OF YEARS. SUCH STORAGE PROBLEMS MUST BE SOLVED IF WE INTEND TO MAKE MORE EXTENSIVE USE OF THE "FRIENDLY ATOM." STORAGE ISN'T THE ONLY PROBLEM WITH RAD WASTES. SAFE TRANSPORTATION TO STORAGE SITES AND SAFE HANDLING POSE ADDITIONAL PROBLEMS.

UP TO THIS POINT I HAVE DISCUSSED ONLY THE SMALL CONTRIBUTORS TO THE NATION'S OVERALL SOLID WASTE PROBLEM. ACCORDING TO THE AUTHORS OF THE BOOK ECOLOGY: MAN'S RELATIONSHIP TO HIS ENVIRONMENT, OUR SOLID WASTE PRODUCTION IN 1970 REACHED ABOUT 4 1/2 BILLION TONS. ONLY ABOUT SIX PERCENT OF THAT CAME
*8 FROM RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SOURCES. ABOUT TWO BILLION TONS, THAT IS OVER 44%, CAME FROM LIVESTOCK AND OTHER AGRI-BUSINESS OPERATIONS. SINCE 1970, THAT PERCENTAGE APPEARS TO HAVE INCREASED. A RECENT PUBLICATION FROM THE UNITED STATES BUREAU OF SOLID WASTE MANAGEMENT REPORTS THAT AS HICH AS 57% OF OUR SOLID WASTES ARE CURRENTLY FROM AGRICULTURAL ACTIVITIES. THE EARLIER REPORT POINTED OUT THAT ABOUT 1.7
*9 BILLION TONS, AROUND 39% OF OUR SOLID WASTES, WERE WHAT THEY CALL MINERAL SOLID WASTES, MOSTLY FROM MINING OPERATIONS INCLUDING THE MILLING AND PROCESSING INDUSTRIAL WASTE MATERIALS. COPPER MINING FOLLOWED BY IRON, SOFT COAL, AND PHOSPHATE BEARING ROCK CONTRIBUTED MOST TO THIS KIND OF MINING SOLID WASTE.

ALTHOUGH VERY LARGE IN AMOUNT, THE MINERAL WASTES AND MUCH OF THE AGRICULTURAL WASTES ARE OFTENTIMES FAR FROM POPULATION CENTERS. FOR THAT REASON, THEY ARE SELDOM CONSIDERED IN DISCUSSIONS ON SOLID WASTE MANAGEMENT PROBLEMS. BUT SLAG HEAPS, MINE TAILINGS, FEEDLOT WASTES, AND SEDIMENT FROM FARM FIELD EROSION AND FROM EROSION FROM AROUND CONSTRUCTION SITES DO CAUSE SERIOUS PROBLEMS. EROSION ALONE, IN MOST CASES THE RESULT OF HUMAN ACTIVITY, ACCOUNTS FOR A LARGE PART OF THE TWO MILLION TONS OF SEDIMENT THAT REACHES THE MOUTH OF THE MISSISSIPPI RIVER DAILY. I DON'T THINK ANYONE KNOWS HOW MUCH MORE SEDIMENT IS DEPOSITED ON ROUTE, MUCH OF IT FILLING THE MANY RESERVOIRS WE HAVE CONSTRUCTED IN THE NAME OF FLOOD CONTROL, TRANSPORTATION, AND RECREATION ALONG OUR RIVERS.

THE IMPACT OF FEEDLOT MANURE ON THE QUALITY OF SURFACE WATERS AND GROUND WATERS CAN CAUSE IMMEDIATE ENVIRONMENTAL PROBLEMS IN FARMING AREAS AND OTHER PROBLEMS DOWNSTREAM ON WATERSHEDS. A DISCUSSION OF THIS FACET OF WATER POLLUTION, SOMETHING THAT CONTRIBUTES TO WHAT WE CALL CULTURAL EUTROPHICATION, IS A MAJOR PART OF ANOTHER PRESENTATION IN THIS SERIES. BUT MOST AMERICANS, RECALL, DON'T LIVE NEAR THE LARGE AMOUNTS OF MINERAL AND AGRICULTURAL SOLID WASTES, AND HENCE, THEY AREN'T TOO OBVIOUS TO MOST OF US. THE 30 MILLION TONS OF FLY ASH PRODUCED BY INDUSTRIES SUCH AS OUR COAL-BURNING ELECTRIC UTILITIES SEEMS TO BE MORE APPARENT TO MORE PEOPLE. PARTICULATE MATTER IN THE AIR OVER OUR CITIES IS A MAJOR ENVIRONMENTAL PROBLEM. I MENTION IT HERE BECAUSE IT IS CONSIDERED TO BE A SOLID WASTE PROBLEM, BUT IT ALSO WILL BE CONSIDERED IN MORE DETAIL IN A PRESENTATION ON AIR QUALITY.

YOU CAN SEE THAT OUR SOLID WASTES COME IN A VARIETY OF STYLES AND KINDS FROM A VARIETY OF SOURCES. WHY ARE SOLID WASTES CAUSING PROBLEMS? THE

ACTIVITIES OF CIVILIZED MAN HAS PRODUCED SOLID WASTES FOR CENTURIES. NO,
*11 THE PROBLEMS AREN'T NEW, BUT THEY SEEM TO BE GROWING. COULD ONE OF THE
REASONS WE ARE FEELING RATHER INUNDATED IN SOLID WASTES HAVE TO DO WITH
THE FACT THAT THE WORLD IS CURRENTLY GROWING POPULATION-WISE? WE'RE
215 GROWING AT A RATE OF OVER 180,000 PEOPLE PER DAY. THAT'S NOT 180,000
BIRTHS, THAT'S 180,000 PEOPLE. IN WORLD POPULATION, WE'RE CURRENTLY
ABOUT 3.6 BILLION IN NUMBER. MUCH OF THE WORLD DOESN'T SEEM TO BE
SUFFERING FROM THE SOLID WASTE PROBLEM THAT WE HAVE IN THE UNITED STATES.
MAYBE WE SHOULD ASK QUESTIONS ABOUT OUR POPULATION. WE MAKE UP ONLY
220 SIX OR SEVEN PERCENT OF THE WORLD'S POPULATION. THAT AMOUNTS TO LESS THAN
A QUARTER OF A BILLION PEOPLE. AND AS YOU PROBABLY KNOW, WE ARE CURRENTLY
GROWING AT A RATHER LOW RATE COMPARED TO POPULATION GROWTH IN MANY
COUNTRIES. IT DOESN'T APPEAR THAT AMERICA'S ANNUAL PRODUCTION OF 4 1/2
BILLION TONS OF SOLID WASTES ARE DUE TO OUR POPULATION SIZE ALONE. COULD
225 OUR WAY OF LIFE, HOW AND WHERE WE LIVE HAVE SOMETHING TO DO WITH THE
PROBLEM? WE USED TO BE RATHER SPREAD OUT. BACK IN 1800, ONLY FIVE
PERCENT OF OUR POPULATION LIVED IN TOWNS LARGER THAN 2,500 PEOPLE. NOW
70% OF US LIVE IN CITIES OF OVER 100,000 POPULATION. IT IS PREDICTED
THAT BY THE TURN OF THE CENTURY, 80 TO 90 PERCENT OF US WILL LIVE IN
230 LARGE METROPOLITAN AREAS. AS WE GATHER TOGETHER IN LARGE CITIES, OUR
COMMERCIAL, OUR RESIDENTIAL, AND MUCH OF OUR INDUSTRIAL SOLID WASTES
BECOME MUCH MORE THAN A HEADACHE. COULD IT BE THAT HOW WE LIVE CONTRIBUTES
*12 TO OUR SOLID WASTE PROBLEMS? EVERY MAN, WOMAN AND CHILD IN THIS COUNTRY
ON THE AVERAGE GENERATES ABOUT 5.3 POUNDS OF SOLID WASTES PER DAY. THAT'S
235 ABOUT DOUBLE THE PER PERSON DAILY WASTE PRODUCTION THAT WE HAD IN THIS

COUNTRY JUST 50 YEARS AGO. AND 5.3 POUNDS PER PERSON PER DAY IS POSSIBLY ABOUT HALF WHAT WE MIGHT EXPECT TO HAVE IN LESS THAN 15 YEARS. WE DO SEEM TO HAVE A "HIGH CONSUMPTION" LIFE STYLE. IT'S BEEN SAID BY A NUMBER OF AUTHORS THAT A CHILD BORN IN THE UNITED STATES IS EQUIVALENT TO ABOUT 50 CHILDREN BORN IN SOME OF THE NOT SO HIGHLY INDUSTRIALIZED COUNTRIES. A CHILD BORN IN THIS COUNTRY MAY EXPECT TO CONSUME OR RATHER USE 50 TIMES THE GOODS AND MATERIALS THAT A CHILD BORN IN INDIA, FOR EXAMPLE, MIGHT USE IN HIS LIFETIME. AND BY THE WAY, WE DO USE THE EARTH'S RESOURCES. WE DON'T CONSUME THEM. IN ONE FORM OR ANOTHER THEY DO REMAIN IN THIS THIN SHELL OF EARTH WE LIVE ON AND THE THIN SHELL WE RELY ON FOR ALL OF OUR MINERALS.

*13 THIS SIGN WHICH TELLS THE PUBLIC THAT AN AUTOMOBILE DEALER IS THE LARGEST OF THAT KIND IN A DEFINED GEOGRAPHIC REGION IS A LEGITIMATE STATEMENT OF FACT. BUT THE GENERAL IDEA THAT "BIG IS BEAUTIFUL" BOTHERS ME. HAVEN'T WE AMERICANS TAKEN ON THIS SLOGAN AS A WAY OF LIFE -- AS A GUIDING PRINCIPLE? IT SEEMS TO ME THAT WE HAVE THIS IDEA WELL INGRAINED IN OUR BEHAVIOR ALREADY. "BIG" NOT ONLY APPLIES TO THE SIZE OF OBJECTS BUT IT ALSO APPLIES TO THE NUMBER OF THINGS WE USE. CERTAINLY WE HAVE MATERIAL NEEDS, BUT IT SEEMS THAT IN RECENT YEARS WE'VE ADDED A GREAT MANY MATERIAL WANTS. SHOULD WE START ASKING QUESTIONS ABOUT THE HIDDEN COST OF OUR "WANT" POSSESSIONS? NOT JUST THE PURCHASE PRICE, BUT THE REAL PRICE: THE COST OF THE ENERGY, THE COST OF THE NATURAL RESOURCES USED TO MAKE THEM, THE COST TO TRANSPORT THE MATERIALS, THE COST OF THE SOLID WASTE MANAGEMENT PROBLEMS THAT RESULT IN THE DISPOSAL OF THE REMAINS OF THESE WANTS? THOUSANDS OF PEOPLE HAVE BEEN FORCED INTO THINKING ABOUT DISPOSAL COSTS BECAUSE OF THE CLOSING OF

DUMPING SITES. I DON'T KNOW HOW MANY OF US, IN STARTING TO FACE THE
*14 EVER-GROWING COST OF SOLID WASTE MANAGEMENT, HAVE CONSIDERED HOW OUR OWN
PERSONAL LIFE STYLES MIGHT INFLUENCE THESE COSTS. TO BE SURE, SOME
PEOPLE HAVE CONCLUDED WITH THE SIMPLE GENERALIZATION THAT "WE CAN'T STOP
265 PROGRESS," THAT ANY CHANGES IN LIFE STYLES WOULD RESULT IN CATASTROPHIC
UPHEAVALS OF OUR ECONOMIC SYSTEM. WHAT DO YOU THINK? I ASK THAT WE
CONTINUE TO ASK QUESTIONS ABOUT OUR USE OF RESOURCES, QUESTIONS ABOUT
OUR NEEDS, QUESTIONS ABOUT OUR WANTS, AND QUESTIONS ABOUT OUR VALUES.
IN A MOMENT I'D LIKE TO HAVE THE PRESENTATION LEADER TURN OFF THE AUDIOTAPE
270 AND SLIDE PROJECTOR TEMPORARILY SO THAT YOU CAN DISCUSS THE FOLLOWING
QUESTIONS. QUESTION ONE: WHAT SEEMS TO BE SOCIETY'S PROBLEMS WITH SOLID
WASTES? QUESTION TWO: WHAT DO WE DO THAT CONTRIBUTES TO PROBLEMS IN
SOLID WASTE MANAGEMENT? QUESTION THREE: WHY DO WE DO THINGS THAT CONTRI-
BUTE TO PROBLEMS OF SOLID WASTES AND SOLID WASTE MANAGEMENT?

275 I HOPE YOUR DISCUSSION WENT WELL. NOW I WOULD LIKE TO CONSIDER SOME
QUESTIONS THAT ASK "HOW SERIOUS" OUR SOLID WASTE MANAGEMENT PROBLEMS
ARE -- QUESTIONS ABOUT HOW MUCH OF THE PROBLEMS WE THINK WE CAN TOLERATE,
AND WHAT THE EFFECTS OF OUR PLANNING -- OR FAILURE TO TAKE ACTION --
*15 MIGHT HAVE ON FUTURE GENERATIONS. A SURVEY CONDUCTED BY THE NATIONAL
280 LEAGUE OF CITIES AND THE U.S. CONFERENCE OF MAYORS INDICATED RECENTLY
THAT THEY THINK ABOUT HALF OF THE NATION'S CITIES CURRENTLY NEED SANITARY
LANDFILL SITES. ON THE BASIS OF THIS SURVEY, THE TWO MUNICIPAL GROUPS
ALSO RECOMMENDED A LARGE SCALE RECYCLING EFFORT. THE IDEA WAS BASED ON
THEIR FINDINGS THAT CITIES THROUGHOUT THE NATION ARE EAGER TO ADOPT
285 INCREASED RECYCLING. THE SURVEY ALSO INDICATED THAT RECYCLING EFFORTS ARE

CURRENTLY BEING HELD BACK BY FEDERAL REGULATIONS AND BY MARKET CONDITIONS THAT MAKE IT FINANCIALLY A BURDEN TO RECYCLE MANY SOLID WASTE MATERIALS. LANDFILL SITE PROSPECTS CURRENTLY POSE SOME SERIOUS PROBLEMS AT THE STATE
*16 AND LOCAL LEVELS TOO. EFFORTS IN WISCONSIN ARE DIRECTED AT THE IDEA OF
290 COUNTY-WIDE PLANNING AND DEVELOPMENT OF COOPERATIVE LANDFILL SITES. EARLY IN 1973 THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES REPORTED THAT LOCAL GOVERNMENTS WERE LAGGING IN THIS PLANNING AND THAT AT THAT TIME ONLY ONE COUNTY HAD AN APPROVED COUNTY PLAN AND THAT ALTHOUGH TWO OTHER COUNTIES PROVIDED SITES, THE SITES THEMSELVES HAD NOT YET BEEN CERTIFIED.
295 WHEN SUCH LANDFILL PLANS HAVE BEEN ESTABLISHED ARE THE NEEDS OF PEOPLE THEN BEING MET? CERTAINLY NOT. MANY DECISIONS MUST STILL BE MADE AS TO WHAT SITES ARE AVAILABLE, WHAT SITES HAVE ADEQUATE TOPOGRAPHIC AND SOIL CONDITIONS, WHAT SITES DON'T POSE PROBLEMS TO NEIGHBORING PROPERTIES, WHAT SITES TAKE INTO ACCOUNT FUTURE SITE USE. WHETHER THE SITES PROVIDE
300 FOR POSSIBLE FUTURE RECOVERY OF RARE OR NEEDED SOLID WASTES IS ALSO A CONSIDERATION. AND CERTAINLY, PURCHASE PRICE AND COST TO THE CITIZENS FOR THE USE OF THE SITES MUST ALSO BE CONSIDERED.

LET'S TAKE ANOTHER LOOK AT SOME OF OUR LARGE VOLUME SOLID WASTE PROBLEMS.
*17 HOW SERIOUS ARE PROBLEMS WITH THE MILLIONS OF TONS OF MINING AND MILLING
305 SOLID WASTES? IF YOUR PROPERTY IS NEAR A STRIP MINE OR NEAR MINE TAILING SITES, OR IF YOUR PROPERTY HAS BEEN DEVALUED BECAUSE OF ITS CLOSENESS, YOU MAY HAVE REASON TO BELIEVE THE PROBLEMS ARE SERIOUS. I SUGGEST THAT THE PROBLEMS ARE SERIOUS EVEN THOUGH THEY MAY BE FAR AWAY FROM YOU. THE WASTES DO INFLUENCE HOUSING, FOOD PRODUCTION, AND RECREATIONAL LANDS OF SOMEONE,
310 SOMEWHERE. YOUR TAX MONEY IS USED NOT ONLY TO HELP RECLAIM AREAS EFFECTED BY CERTAIN KINDS OF MINING, BUT ALSO TO SUBSIDIZE MANY VIRGIN MATERIAL

MINING OPERATIONS. POSSIBLY YOU AGREE THAT THESE ARE GOOD POLICIES, BUT I THINK WE SHOULD ASK ABOUT WHAT ALTERNATIVE METHODS MIGHT BE AVAILABLE TO HELP PAY FOR THE SOLID WASTES THAT RESULT FROM MINING AND ASSOCIATED PROCESSING. SHOULD SUCH PAYMENT BE A BIGGER PART OF THE CONSUMER'S PURCHASE PRICE FOR METALLIC PRODUCTS, FERTILIZERS, AND OTHER MINED MATERIALS? WHAT SHOULD BE THE RESPONSIBILITY OF MINING COMPANIES IN MANAGEMENT OF THEIR WASTE MATERIALS? WHAT, FOR EXAMPLE, ARE THE RESPONSIBILITIES OF MINING INDUSTRIES THAT DEPOSIT IRON TAILINGS IN OUR LAKES? WHAT MIGHT BE SOME LONG RANGE EFFECTS OF SUCH PRACTICES? ARE THEY TOLERABLE NOW? WILL THEY BE TOLERABLE IN THE FUTURE?

THE SOLID WASTES OF URANIUM MINING AGAIN POSE SOME SPECIAL PROBLEMS. SOME OF THE MATERIALS USED IN THE LANDFILL AROUND BUILDINGS AND IN THE AGGREGATE USED IN THE CONCRETE OF MANY HOMES AND OTHER BUILDINGS IN GRAND JUNCTION, COLORADO, IS FROM URANIUM MINE SOLID WASTE MATERIALS -- AND THESE ARE "HOT" MATERIALS. MONITORING FOR RADIOACTIVITY IN THAT COMMUNITY HAS SHOWN THAT MANY OF THE HOMES AND SOME SCHOOLS AND OTHER PUBLIC BUILDINGS ARE WELL OVER DESIRABLE RADIOACTIVITY LEVELS FOR LONG TERM EXPOSURE. RESEARCH ON THE BIOLOGICAL EFFECTS OF LONG-TERM RADIATION INDICATE THAT VARIOUS KINDS OF OUR BODY CELLS AND VARIOUS GENETICALLY IMPORTANT PARTS OF OUR CELLS ARE VERY INTOLERANT TO CHRONIC, THAT IS LONG TERM, LOW DOSE GAMMA RADIATION. IT APPEARS THAT IN GRAND JUNCTION, COLORADO, THAT SOME PEOPLE ARE WILLING TO GAMBLE WITH THE LIVES OF OTHERS.

HOW MUCH ARE YOU WILLING TO GAMBLE WITH OUR LIVES AND WITH OUR CHILDREN'S LIVES? A SOMEWHAT SIMILAR SOLID WASTE PROBLEM ARISES FROM THE PROBLEM OF RAD WASTES FROM NUCLEAR POWER GENERATING PLANTS. PERIODICALLY THE SPENT FUEL MUST BE REPROCESSED IN ORDER TO RECOVER SOME USABLE URANIUM AND PLATONIUM

AND TO DISPOSE OF OTHER MATERIALS. THE ATOMIC ENERGY COMMISSION IS WELL AWARE OF THE DANGERS INHERENT IN THE PROCESSING, TRANSPORTATION, AND STORAGE OF THESE MATERIALS, AND THE ATOMIC ENERGY COMMISSION HAS HAD AN EXCELLENT SAFETY RECORD IN THESE AND OTHER PRACTICES INVOLVING RADIOACTIVE MATERIALS. BUT ACCIDENTS DO HAPPEN. ON FEBRUARY 25, 1968, THE ROCHESTER, NEW YORK, DEMOCRAT CHRONICAL CARRIED A HEADLINE ARTICLE THAT REPORTED THE EFFLUENT OF AN ATOMIC WASTE AND REPROCESSING PLANT IN CATTARAUGUS COUNTY AS CONTAINING 2,800 TIMES THE LEGAL LIMIT OF STRONTIUM 90. IN THE ARTICLE, DR. GEORGE BERG, CHAIRMAN OF A SUBCOMMITTEE ON RADIOACTIVE POLLUTION IN THE DEPARTMENT OF RADIATION BIOLOGY AT THE UNIVERSITY OF ROCHESTER, POINTED OUT THAT THERE WAS NO IMMEDIATE DANGER TO LOCAL RESIDENTS. BUT HE ALSO POINTED OUT THAT CATTARAUGUS CREEK DRAINS INTO LAKE ERIE AND THEN INTO LAKE ONTARIO, AND THAT IF THIS POLLUTION CONTINUED THERE WOULD BE SERIOUS PROBLEMS FOR THOSE WHO OBTAIN THEIR DRINKING WATER FROM THESE LAKES. HOW MANY SUCH ACCIDENTS WITH THESE SORTS OF WASTES CAN WE TOLERATE? WHAT IS THE PRICE FUTURE AMERICANS WILL PAY IF WE GET IN THE HABIT OF BECOMING TOO TOLERANT OF RADIOACTIVE WASTE MANAGEMENT PROBLEMS?

LET'S RETURN TO A HIGH VOLUME SOLID WASTE PROBLEM. HOW SERIOUS ARE THE SOLID WASTES THAT RESULT FROM OUR AGRI-BUSINESS? HOW SERIOUS, FOR EXAMPLE, *19 ARE PROBLEMS WITH FEEDLOT SOLID WASTES AND SLAUGHTERHOUSE WASTE MATERIALS? IF YOU LIVE DOWNWIND FROM SUCH PLACES, THE PROBLEMS MAY BE FOREMOST IN YOUR MIND UNLESS OR UNTIL YOUR SENSES BECOME ACCUSTOMED TO THEM. IF A PERSON'S NOSE CAN ADAPT TO THESE PROBLEMS, CAN ONE'S WATER SUPPLY OR SANITARY SEWAGE SYSTEM ADAPT AND AT WHAT PRICE WILL THEY ADAPT? WILL TOLERANCE OF THESE KINDS OF WASTES BECOME A CUSTOM THAT FUTURE GENERATIONS WILL BE EXPECTED, EVEN OBLIGATED, TO TOLERATE? SOMEWHAT MORE REMOTE FROM MOST OF US BUT VERY MUCH A PART OF THE LIVES OF ALL OF US ARE THE SOLID

WASTE PROBLEMS RESULTING FROM POOR LAND MANAGEMENT PRACTICES ON FARM LAND.
*20 FERTILE TOP SOIL IS ONE OF OUR MOST IMPORTANT RESOURCES. IT IS NO LONGER A RESOURCE WHEN, BECAUSE OF POOR LAND MANAGEMENT, IT'S ERODED AWAY FROM OUR FIELDS, TRANSPORTED AS SEDIMENT IN OUR WATERSHEDS AND DEPOSITED BEHIND DAMS, ON FLOOD PLAINS, ON PEOPLE'S YARDS, AND EVEN MAYBE IN THEIR BASEMENTS. CAN WE TOLERATE THE LOSS OF MILLIONS OF TONS OF FERTILE LAND ENDING UP ON OUR STREAM BOTTOMS AND IN OUR DELTAS EACH YEAR?

WE HAVE IN THE PAST HAD A VARIETY OF PROGRAMS DESIGNED TO PROVIDE INCENTIVES TO PROTECT THE QUALITY OF THE NATION'S SOILS. HAVE THE PROGRAMS DONE THE
*21 JOB? IF NOT, COULD A PARTIAL SOLUTION INVOLVE ENACTING LEGISLATION, MONITORING AND ENFORCEMENT POLICIES AND AGENCIES TO INSURE SOIL QUALITY FOR FUTURE GENERATIONS? POSSIBLY A BETTER QUESTION MIGHT BE, DOES LAND OWNERSHIP INCLUDE THE PRIVILEGE OF MISUSE OF THE SOIL?

LET'S TAKE A BREAK NOW TO GIVE YOU A CHANCE TO DISCUSS THE QUESTIONS I'VE BEEN RAISING. ONE QUESTION, HOW SERIOUS ARE OUR PROBLEMS WITH SOLID WASTES AND SOLID WASTE MANAGEMENT? THE SECOND QUESTION, HOW MUCH OF OUR PROBLEMS WITH SOLID WASTES DO YOU THINK WE WILL BE ABLE TO TOLERATE NOW AND IN THE FUTURE? AND THE FINAL QUESTION, WHAT MIGHT BE SOME OF THE EFFECTS OF OUR TOLERANCE OF CERTAIN DEGREES OF SOLID WASTE MANAGEMENT PROBLEMS ON FUTURE GENERATIONS?

NOW LET'S CONSIDER SOME OF THE EFFORTS THAT ARE BEING MADE TO ALLEVIATE
*22 OR SOLVE VARIOUS SOLID WASTE PROBLEMS. THERE ARE EFFORTS IN EDUCATION, IN RESEARCH AND DEVELOPMENT, AND IN LEGISLATION (AT ALL LEVELS OF GOVERNMENT). EFFORTS IN ENVIRONMENTAL LEGISLATION HAVE MUSHROOMED IN RECENT YEARS. IT IS DIFFICULT TO KEEP UP WITH THE CHANGES IN SOLID WASTE MANAGEMENT

LEGISLATION BUT THERE ARE A NUMBER OF ORGANIZATIONS THAT CAN ASSIST PEOPLE. YOUR LOCAL NEWSPAPERS, BY THE WAY, OFFER AN EXCELLENT SOURCE OF INFORMATION ON CHANGES IN LEGISLATION. THE CONSERVATION REPORT AND THE CONSERVATION NEWS ARE TWO FREE PUBLICATIONS THAT CAN HELP YOU KEEP INFORMED. NEAR THE END OF THIS PRESENTATION THERE WILL BE A DESCRIPTION OF THE BOOKLETS AND A SLIDE THAT SHOWS THE ADDRESS TO WHICH ONE CAN WRITE TO OBTAIN THESE RESOURCES. RECENTLY IN THE CONSERVATION REPORT, FOR EXAMPLE, ONE COULD FIND INFORMATION ON NEW LEGISLATION ON OPERATION REGULATIONS ON STRIP MINING. ALSO REPORTED WAS THE FACT THAT HEARINGS CONTINUED TO BE HELD ON THE FINDINGS OF THE LIMITS TO GROWTH STUDY OF THE CLUB OF ROME. IN MARCH, 1973, IT WAS REPORTED THAT AN ENVIRONMENTAL PROTECTION AGENCY REPORT ON SOLID WASTE MANAGEMENT WAS IN THE WHITE HOUSE OFFICE OF MANAGEMENT AND BUDGET. IT WAS ALSO REPORTED, HOWEVER, THAT THIS REPORT HAD BEEN THERE FOR A NUMBER OF MONTHS WITHOUT ANY ACTION. AMONG THE RECOMMENDATIONS

*23 OF THIS REPORT THERE WAS A SUGGESTION THAT WE MIGHT USE TAX INCENTIVES OR SUBSITY PAYMENTS TO PROMOTE THE USE OF RECYCLED PRODUCTS. THE REPORT ALSO RECOMMENDED MORE AGGRESSIVE PROCUREMENT POLICIES BY THE FEDERAL GOVERNMENT TO LIMIT THE USE OF VIRGIN MATERIALS IN ITS PURCHASING. THE IDEA OF FORMER ENVIRONMENTAL PROTECTION AGENCY HEAD RUCKELHOUSE, THAT THE PRINCIPAL OBSTACLES TO RESOURCE RECOVERY ARE ECONOMIC AND INSTITUTIONAL RATHER THAN TECHNOLOGICAL WERE SUGGESTED. IN THE SAME MONTH, THE SENATE

*24 GAVE FINAL CONGRESSIONAL APPROVAL TO HOUSE BILLS THAT EXTEND SOLID WASTE DISPOSAL AND CLEAN AIR ACTS FOR ONE MORE YEAR. THE SOLID WASTE BILL ASSISTS IN THE DEVELOPMENT OF RECYCLING AND DISPOSAL TECHNIQUES AND ALLOWS FOR SOME RESEARCH INTO MINING SOLID WASTE PROBLEMS, IN ADDITION TO PROVIDING SOME FINANCIAL ASSISTANCE TO CITIES AND STATES IN THEIR SOLID WASTE MANAGEMENT

PROBLEMS. ALTHOUGH ALMOST $240 MILLION HAD BEEN AUTHORIZED BY CONGRESS FOR VARIOUS KINDS OF ASSISTANCE AND RESEARCH IN THIS ACT, IT WAS REPORTED THAT
*25 IT IS PROBABLE THAT LESS THAN 3% OF THE MONEY WILL BE SPENT. SHOULD WE BE ASKING WHY SUCH AUTHORIZED FUNDS FOR THIS AND MANY OTHER ENVIRONMENTAL
420 PROGRAMS ARE SELDOM SPENT? TO WHOM SHOULD SUCH QUESTIONS BE DIRECTED? KEEPING UP ON ENVIRONMENTAL LEGISLATION IS EXTREMELY IMPORTANT -- LETTING YOUR ELECTED AND APPOINTED REPRESENTATIVES KNOW YOUR FEELINGS ON SUCH
*26 MATTERS IS ALSO IMPORTANT. I SUGGEST THAT INTERESTED PEOPLE MAKE CONTACT WITH THE OFFICE OF SOLID WASTE MANAGEMENT IN THE ENVIRONMENTAL PROTECTION
425 AGENCY IN WASHINGTON, D.C.

WHAT IS NEW IN PEOPLE BEHAVIOR DIRECTED TOWARD SOLVING OUR SOLID WASTE
*27 PROBLEMS? WHAT'S NEW IN RESEARCH AND DEVELOPMENT? IN THOSE AREAS AGAIN THE ONLY THING THAT SEEMS CONSTANT IS CHANGE. MANY PEOPLE ARE INVOLVED AND ARE TRYING INNOVATIVE APPROACHES. SOME OF THEM ARE RESURRECTING OLD
430 APPROACHES. PORTABLE JUNKED CAR CRUSHERS HAVE BEEN DESIGNED, BUILT, AND ARE FUNCTIONING IN SOME AREAS EVEN THOUGH TRANSPORTATION COSTS AND
*28 MARKET PRICES STILL POSE PROBLEMS. IN 1974, BALTIMORE, MARYLAND, USING A NEW RESOURCE RECOVERY PLANT, PLANS TO CONVERT ABOUT HALF THE CITY'S TOTAL SOLID WASTE INTO SYNTHETIC GAS THAT WILL BE USED TO RUN A STEAM
435 GENERATING ELECTRICITY PLANT. THEY EXPECT TO EXTRACT METALS AND GLASS WORTH $1 1/2 MILLION ANNUALLY TO THE CITY EARLY IN THE PROCESS. PONTIAC, MICHIGAN, PLANS A SIMILAR ENERGY FROM SOLID WASTE PROJECT. PART OF
*29 NEW YORK CITY'S SOLID WASTE WILL GO INTO ORGANIC FERTILIZERS AND MULCH PRODUCTS IN A JOINT EFFORT OF GENERAL ELECTRIC COMPANY AND ECOLOGY, INC.
440 A CITY IN DELAWARE PLANS A SIMILAR PROGRAM IN WHICH COMPOST AND A SOIL

CONDITIONER WILL BE PRODUCED FROM SOLID WASTES AND SEWAGE SLUDGE. A DEMONSTRATION RESOURCE RECOVERY PLANT IN CASA GRANDE, ARIZONA, CONVERTS CATTLE MANURE INTO A HIGH PROTEIN SUPPLEMENT FOR LIVESTOCK FEED. ANOTHER SIMILAR PROJECT PRODUCES, IN ADDITION, ENOUGH METHANE GAS TO OPERATE THE SYSTEM. FOR MORE INFORMATION ON THESE SORTS OF ACTIVITIES I SUGGEST THAT SOME ORGANIZATIONAL NEWSLETTERS OFFER UP-TO-DATE INFORMATION. FOR EXAMPLE, THE NEWSLETTER OF THE WISCONSIN COALITION FOR RECYCLING, PUBLISHED BY ENVIRONMENT WISCONSIN AT 114 N. CARROLL STREET IN MADISON, IS SUCH A SOURCE. AN EXCELLENT BOOK WRITTEN IN 1970 BY SUZANNE HILTON ENTITLED HOW DO THEY GET RID OF IT? DISCUSSES HUNDREDS OF WAYS IN WHICH TRASH IS CONVERTED INTO TREASURE. SHE DISCUSSES METHODS RANGING FROM THE EXTRACTION OF GOLD AND SILVER FROM FLY ASH TO PLYWOOD GLUE PRODUCTS MADE BY USING BEEF BLOOD.

WHAT ARE INDIVIDUALS DOING IN THEIR HOMES AND ON THEIR JOBS THAT REFLECT THEIR CONCERN WITH SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY? EXCEPT FOR INSTANCES OF REDUCED SPENDING THAT SEEM TO HAVE RESULTED FROM CLIMBING PRICES, I HAVEN'T DETECTED ANY APPRECIABLE CHANGES IN CONSUMPTION -- RATHER "USE" OF MATERIALS. BUT MANY PEOPLE ACROSS THE COUNTRY HAVE GIVEN THOUGHT AND EFFORT TO RESOURCE RECOVERY THROUGH A VARIETY OF RECYCLING PROGRAMS. MANY WHO HAVE NEVER SEPARATED THEIR HOME SOLID WASTES BEFORE -- OR AT LEAST SINCE WORLD WAR II EFFORTS -- NOW RELIGIOUSLY SEGREGATE AND PROCESS THEIR PAPER, GLASS, AND METAL WASTES FOR RECYCLING. CHILDREN IN A NUMBER OF SCHOOLS HAVE BEEN VERY INSTRUMENTAL IN SOME OF THESE EFFORTS, AND THAT -- THAT IS, THE CONCERN AND INVOLVEMENT OF YOUTH -- TO ME IS A REASON FOR OPTIMISM IN THIS ENVIRONMENTAL MATTER. THE HOME GARBAGE SURVEY OF PROJECT WASTE INVOLVES THE COOPERATIVE EFFORTS OF THOUSANDS OF HIGH SCHOOL

STUDENTS WORKING WITH THEIR TEACHERS AND OTHER ADULTS IN A SIX STATE SURVEY IN THE SOUTH AND SOUTHEAST UNITED STATES. EVEN THE PAPER USED FOR NECESSARY COMMUNICATION IN THAT PROJECT WAS RECYCLED MATERIAL COMING FROM A PAPER MILL IN APPLETON, WISCONSIN.

OTHER SOLID WASTE MANAGEMENT EFFORTS HAVE BEEN MADE BY CONCERNED STUDENTS IN JUNIOR HIGH SCHOOLS AND HIGH SCHOOLS OF GREEN BAY AND MILWAUKEE, WISCONSIN. THESE AND OTHER EFFORTS TO PLAN FOR THE FUTURE LIFE QUALITY OF PEOPLE ARE A LEGITIMATE PART OF OUR ELEMENTARY AND SECONDARY SCHOOL PROGRAMS. BUT COMMUNITY ADULT SUPPORT AND ASSISTANCE IS NEEDED AND WILL CONTINUE TO BE NEEDED TO HELP YOUTH IN BOTH THEIR ENVIRONMENTAL EDUCATION AND IN THEIR ENVIRONMENTAL ACTION EFFORTS.

AIR QUALITY

What air is - components.
Where it is found (dissolved to upper atmosphere).
Why man and other living things need air.
How air has changed over time:

1. Over long periods - geologic time- including cosmic dust, sand storms, marsh gases, fires, pollens, volcanic dust, etc.
2. In recent times (post industrial revolution)

What are major "man-made" pollutants of air?
Particulate matter, fly ash, etc.
SO_2, CO_2, CO, nitrogen oxides, photochemical smog, (hydrocarbon), lead, fluorides, asbestos, odorous and obnoxious materials such as HS_2 and mercaptans

What effects do these have on people?

1. Health - chronic disease such as asthma, emphysema, pneumonia, cancer
2. Crops and vegetation
3. Clothing
4. Buildings
5. Machinery, vehicles, etc.
6. Amenities of life

The air of the city versus the "country air."
What currently is being done to alleviate air quality problems?

1. Air legislation
2. Air monitoring
3. Various air quality control devices and practices

What additional regulations, behaviors, etc. might be used to combat reduced air quality?

LIFE QUALITY PRESENTATION

Outline

1. Questions on human societal needs and wants
   A. Varying views on life quality
      1) Human needs and wants
         a) Physiological
         b) Social
         c) Psychological
      2) Changes in needs and wants of society in time

2. How our values influence our use of natural and man-made environments?

3. How our values are influenced by the environments?

4. What is real communication?

5. What do value and communication have to do with citizen involvement in environmental decision processes?

TRANSPORTATION AND LAND USE PRESENTATION

Outline

1. Introduction
   A. Past transportation modes and past needs
   B. Changing transportation
   C. Impact of changes on land use

2. Elaboration of population growth and affluence on transportation modes and land needs.
   A. Description and environment impacts of common transportation modes
   B. Energy efficiency comparisons of transportation modes
      1) freight movement
      2) passenger movement

3. Current land use practices
   A. Housing
   B. Food
   C. Transportation
   D. Recreation

4. Future transportation needs and land use needs

5. Citizen involvement in decisions affecting land use and transportation

WATER QUALITY PRESENTATION

Outline

1. Detection of poor water quality
   A. Early evidence, response of legislators, industries and citizens
   B. Growing evidence
   C. Newly defined pollutants

2. Sources and kinds of pollutants
   A. Cities
   B. Industries
   C. Agriculture
   D. Mining and construction

3. Some effects of pollutants
   A. Ground water and health
   B. Surface water
      1) Eutrophication

4. Efforts to reduce water pollution
   A. Actions of concerned citizens
   B. Actions of legislators
   C. Actions of industries
   D. Actions of cities

5. Future of water quality
   A. Health
   B. Recreation
   C. Aesthetics

6. Citizen action roles
   A. Education
   B. Legislation
   C. Individual and household actions

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

INTRODUCTORY SLIDES

Slide #	Slide Subject
1	Project Title
2	New York City Aerial View with Question Mark
3	Door County Coast with Question Mark
4	Close-Up of Book, Who Owns America?
5	Closed Garbage Dump Sign
6	Elephant Analogy Diagram
7	People at Public Meeting
8	Sign, "Objectives: (1) Provide Background (2) Promote Discussion"

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

SUMMARY SLIDES

Slide #	Slide Subject
1	Sign, "Your Voice Is Important--Let It Be Heard!"
2	Sign, "Myths & Facts"
3	President Nixon's Statement On the American Population
4	Close-Up On National Wildlife Legislative Reports
5	Close-Up Of Books, EPA Booklet, and Environmental Practice
6	Children On Environmental Education Field Trip

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

AIR QUALITY

Slide #	Slide Subject
1	Title Slide
2	Composition of Air Diagram
3	List of Natural Air "Pollutant" Materials
4	Aerial View Portion of Manhatten
5	Industrial Smog in Small Illinois Community
6	Major Sources of Air Pollutants
7	Air Pollutants From Industries
8	Consolidated Edison Stacks and United Nations Buildings
9	Paper Mill Affluent, Kimberly, Wisconsin
10	Air Pollutants From Transportation
11	Close-Up of Polluting Automobile
12	Auto Traffic on Freeway
13	Sulphur Compounds Chart
14	Carbon Compounds Chart
15	Nitrogen Oxides Chart
16	Photochemical Smog Chart
17	Photochemical Smog Products Chart
18	Particulate Air Pollutants
19	Diagram of Atmospheric Particle Sizes
20	Costs of Air Pollution
21	Air Emissions From Small Industry
22	Wooded Road
23	Panoramic View of Black Hills South Dakota Grazing Area
24	View of Portion of Detroit
25	View of Tall Business Buildings in Detroit
26	Inversion Diagram Picture
27	Inversion Diagram Graph
28	Small Foundry Air Emissions
29	Paper Mill with Excessive Particulate Matter Emissions
30	Chart, With the Question, "Who's Responsibility?"

78

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

ECOLOGICAL CONCEPTS

Slide #	Slide Subject
1	Title Slide
2	Water Monitoring Equipment
3	Ecosystem Components Diagram
4	"Common Needs of Living Things" Chart
5	"Life Styles" Chart
6	Close-Up of Sugar Maple Seedling
7	View of Deciduous Forest
8	Mare and Colt Grazing
9	Black Swallowtail Butterfly Larva Browsing
10	Close-Up of Deer Mouse
11	Close-Up of Green Frog
12	Close-Up of Bullsnake
13	Close-Up of Young Robin Feeding
14	Rotting Log
15	Close-Up of Ant Colony
16	Close-Up of Amanita Toadstool
17	"Cyclic Movement of Materials" Diagram
18	"One Directional Energy Movement" Diagram
19	"Ecological Pyramid" Diagram
20	"Diversity-Stability" Diagram
21	View of Diversity in Mixed Hardwood-Conifer Woodland
22	"Cultural Eutrophication" Chart
23	Heavy Algae Accumulation on Drainage Ditch
24	"Biologically Important Elements" Chart
25	"Population Change" Graph
26	Selected Reading List of Ecological Concepts

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

ENERGY

Slide #	Slide Subject
1	Title Slide
2	Sun Energy To Man Diagram
3	Chart "Energy--Past and Present"
4	Chart #1 of U.S. Energy Sources from U.S.G.S. Circular 650
5	Chart #2 of U.S. Energy Sources from U.S.G.S. Circular 650
6	Chart on Years' Supply of Various Energy Sources
7	Chart on U.S. Consumption of Fossil Fuels
8	Chart of End Uses of Energy in the U.S.
9	Bus
10	Railroad Frieght Cars
11	Natural Gas Pipeline Station
12	Chart #1 "Energy-Future?"
13	Windmill
14	Hydroelectric Dam
15	Geyser
16	Coal Stockpile
17	Man Putting Gasoline in Auto
18	Chart #2 "Energy-Future?"
19	Nuclear Power Plant
20	Chart #3 "Energy-Future?"
21	Sign "Energy-Yes, At Any Price-No"
22	Sign "Human Behavior"
23	Transmission Lines and Fossil Fuel Power Plant
24	Variety of Electrical Appliances
25	Air Conditioner
26	Lawn Tractor
27	Variety of Power and Self-Propelled Lawn Mowers
28	Fireplace
29	Sign "Is That - Trip, Gadget, Kilowatt Necessary?"
30	Power Plant and Marsh

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

COMMUNICATION, NOISE, AND LIFE QUALITY

Slide #	Slide Subject
1	Title Slide, Communication, Noise, and Life Quality
2	View of Urban League Offices in Detroit
3	View of Flower Beds and Landscaping Around Apartment Bldg.
4	View of Discount Houses and Abandoned Small Business in Inner City
5	View of Hearing Protection Caution Sign
6	View of Follies Theater in Former _____ District of Detroit
7	View of Night Lights in Recreational Urban Area
8	View of Log Cabin in Wooded Setting
9	View of Children Overlooking Lake
10	View of Gas Station, Fast Food Small Business Advertisement
11	View of Community Organic Garden, Ann Arbor, Michigan
12	View of Poor Multi-Dwelling Buildings in City
13	View of Crowd Awaiting Land Transportation at Airport
14	View of Martin Luther King Home in Redeveloped Downtown Detroit
15	View of Elderly Couple Downtown New York City
16	View of Shoppers in Pedestrian Mall in Ottawa, Canada
17	View of Small Green Area in Around Tenement Buildings, Detroit
18	View of Office Building in Wooded Area
19	Aerial View of Suburban Residential Area
20	View of Children Playing on Crowded Beach
21	View of Tourist Town Advertisements Downtown Advertising
22	Close-Up View of No Parking Sign
23	Close-Up View of Sign, Parking In Rear
24	View of Birch and Maple Trees
25	View of Campers Overlooking Mountain Stream
26	View of Old World Architecture in Old Town, Montreal
27	View of No Parking/No Standing Signs Near Church, Downtown New York
28	View of Chicago Skyline Drive
29	View of Chicago Skyline From Inside Automobile
30	View of Plus-Century Old Building Used as Branch Library
31	View of Hickory Bud Opening and New Leaves
32	View of Rest Area Sign Along Super Highway
33	View of Victorian House Being Restored for Small Business Building
34	View of Numerous Super Highway Information Overhead Signs
35	View of New High School
36	View of Trees and Flowers Planted in Old Downtown City Street
37	View of Farm with Encroaching Suburbs in Background
38	View of Few Children Playing on Seashore

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

SOLID WASTE

Slide #	Slide Subject
1	Presentation Title
2	Waste Can With Excess Bags of Garbage
3	"Household Garbage Components" Chart from U.S. Bureau Solid Waste Management Survey
4	"Household Garbage Components" Chart from DSEC Survey
5	Anti-Litter Sign Board
6	Junked Auto Bodies
7	Bottle of Liquid Radwastes
8	Farm, Eroded Hillside, and Sediment-Rich Creek
9	Gravel and Sanding Mining
10	Gully Erosion
11	Graph of Human Population Growth
12	Sign "5.3 Lbs/Person/Day"
13	"Big Is Beautiful" Sign
14	Red Owl Store "Paper Bag Shortage" Sign
15	Green Bay Recycles Sign Board
16	Sanitary Landfill Sign
17	Gravel Mining
18	Nuclear Power Plant
19	Slaughterhouse
20	Farm Field Erosion
21	Sediment-Laden Creek Close View
22	Sign "Education, Legislation, Research & Development"
23	Recycling Site With Excess Materials
24	Dump Site Under Highline Right-of-Way
25	Ten Months Bundled Recyclables in Garage
26	Three Months Supply of Recyclable Household Wastes
27	Garbage Truck
28	Close-Up of Recyclable Pop Bottle and Non-Recyclable 6-Pak Package
29	Trash Dump
30	City Tree Branch Grinder and Truck
31	Abandoned Gravel Quarry Used as a Dumping Site for Tree Bark Wastes
32	Washed, Squashed Tin Cans for Recycling in City Truck
33	Newspaper Bundled for Recycling
34	Boy Emptying Clear Glass for Recycling in City Truck

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

TRANSPORTATION AND LAND USE

Slide #	Slide Subject
1	Antique Automobile (close-up view)
2	Polluting Automobile
3	Mountain Climber
4	Close-Up View of Trail Motorcycle Tracks
5	Close-Up View of Mass Transit Advertisement
6	Erosion Abatement on Steep Hillside Incline
7	View of Suburbs Encroaching on Farmland
8	Crowd of People Awaiting Taxis at Airport
5	View of National Park Shrine
10	Aerial View of Large Group of Taxi Cabs in Downtown Manhattan
11	View of Suburbs, Farmland, and Muskrat Marsh
12	Aerial View of Crowded Urban Parking Lo
13	Aerial View of Interstate Intersection
14	Aerial View of Suburbs Spreading Out From Cities
15	Title Slide Transportation and Land Use
16	Aerial of Rich Farm Soil
17	View of City Street Through City Bus Window
18	View of Road Building Heavy Equipment
19	Erosion in National Park Horse Riding Trail
20	View of Snowmobilers
21	View of Ocean-Going Freighter
22	View of Gasoline Truck
23	View of Railroad Boxcar
24	Aerial View of Super Highway System in Suburb
25	View of Lumber Truck and Forest
26	View of Greyhound Buses
27	Bar Graph of Relative Efficiencies of Different Freight Moving Processes
28	Bar Graph of Relative Energy Efficiencies of Various Passenger Transport Systems
29	Close-Up View of Jet
30	View of Passenger Rail Cars
31	View of Bicycle and Bank-By-Bank Advertising

ENVIRONMENTAL EDUCATION PROJECT

A PROBLEM APPROACH

WATER QUALITY

Slide #	Slide Subject
1	Title Slide
2	View of Children's Diving Board in Tree
3	View of Student Examining Water and Soapsuds on Small Creek
4	View of Variety Detergents
5	View of Pollutants in Creek
6	View of Highly Eutrophic Creek
7	View of Paper Mill on Fox River
8	View of Pulp Processing Plant on Polluted River
9	View of Industry and Business Along Detroit River
10	View of Dairy Cattle Standing in River
11	Close-Up View of Soil Erosion
12	View of Creek with High Sediment Content in Poorly Farm Area
13	View of Contour and Strip Farmed Land
14	View of Farm Feedlot
15	View of Highly Eutrophic Lake
16	View of Small Pond Showing Diversity of Emergent Plants
17	Close-Up View of Arrowhead Pont Plant
18	Close-Up View of Immature Dragonfly
19	Close-Up View of Adult Dragonfly
20	View of Teachers and Students Examining Pond Water
21	Cultural Eutrophication Diagram
22	View of Entrance to Paper Company Water Treatment Faciltiy
23	View of Waste Water Treatment Settling Basins
24	View of City Sewage Treatment Settling Basins
25	Close-Up View at Shoreline Showing Clear Lake Water
26	View of Canoeing Family on River
27	View of Fisherman with Catch
28	View of Youngster Playing Along Northern Woods Lakeshore

HOW TO USE THE ENVIRONMENTAL EDUCATION PRESENTATION MATERIALS

DIRECTIONS FOR PRESENTATION LEADERS

Environmental Education Project
A Problem Approach P.L. 91-516
Dr. Richard W. Presnell
University of Wisconsin-Green Bay
Green Bay, Wisconsin 54302

The brown portfolio contains:

1. Cassette tape recording

2. Set of color slides

3. Booklets and pamphlets

4. The notebook you are reviewing. It contains:

   a. A brief description of the development of these materials

   b. Directions and tips on how to conduct the presentation and lead discussions

   c. A copy of the script for this presentation, showing when each slide is used

   d. A list of the colored slides for this presentation

   e. A copy of the presentation discussion questions

   f. A copy of recommended books and other references available from public libraries

   g. A list of the booklets and pamphlets that accompany this presentation

How these materials were developed

This environmental education presentation is one of seven audio-taped slide presentations developed during 1972 and 1973 with financing provided by an Environmental Education Act grant (Public Law 91-516) to the University of Wisconsin-Green Bay. The presentations are intended to provide information about a variety of environmental problems--information that will assist people in discussing the problems and help promote further, in-depth study of the problems by a concerned citizenry.

The main goal of this project is to convince people that their continued concern and efforts are essential if this nation is to solve both our current and future environmental problems. Members of the following organizations provided encouragement and assistance in the production of these educational materials: the Green Bay Area Chamber of Commerce; the Public School District of Green Bay; the Department of Education of the Diocese of Green Bay; Project I.C.E. of CESA's 9, 3, and 8; the League of Women Voters of Greater Green Bay; Women for Environmental Balance; the Brown County Conservation Alliance; the Environmental Quality Council, Inc.; and staff and faculty from the University of Wisconsin-Green Bay.

The project director, Dr. Richard Presnell of the University of Wisconsin-Green Bay, provided the color slides and wrote and edited the presentation scripts.

HOW TO CONDUCT THE PRESENTATION

1. Things you will need:

   a. Cassette-type tape player (tape recorder)

   b. Slide projector and slide tray

   c. Projection screen or a white or light colored wall

   d. You may need one or two electrical extension cords

2. Setting up.

   Experiment with the tape and slides prior to beginning the presentation. Place the audio cassette in the tape player, with the number one side up. Try the tape and adjust the volume. Listen for the first few minutes of the tape. The instructions on the beginning of the tape will tell you about such aspects of the presentation as previewing the slides and periodic break times for discussion during the presentation.

   Set up the slide projector. Put Introductory Slide Number One in the viewer and focus the slide projector. Note that each slide is labeled with a color code and a number.

   When you have correctly oriented and focused Introductory Slide One, note the relative position of the red and green color codes on the edge of the slide.

   Now place the remaining slides in proper numerical sequence. There are 8 introductory slides, followed by a varying number (about 30) of presentation slides, which are followed by 6 summary slides.

   Place all the slides in the slide projector tray, being certain that the red and green color codes of all slides are oriented in the same manner as the red and green marks on Introductory Slide Number one.

   If time permits, preview the slides to be certain that the projector is in proper running condition and the slides are in the proper viewing position.

   WARNING. After using the slide projector, keep the fan on until the projector has cooled. This will prevent damage to the slides. Upon completion of the presentation, be certain that you remove the final summary slide from the projector.

3. Discussion, questions, and sessions.

Locate the dittoed copies of the discussion questions (in the portfolio) in order to have them available for the audience when they are needed.

As presentation leader you may wish to serve as discussion leader, or you may designate a member of the audience to serve as discussion leader. The discussion leader should become familiar with the discussion questions and should select from the accompanying booklets any booklets that are pertinent to the discussions of this presentation before beginning the program. Some answers to discussion questions and other questions raised may be found in some of the accompanying booklets. Some questions raised during the discussions will undoubtedly go unanswered.

4. Presentation preparation checklist.

Is the audio-tape cassette ready to play beginning at the start of side one?

Is the volume of the tape player set at the appropriate listening level?

Is the slide projector focused?

Are the colored slides in the proper sequence and positions?

Are the discussion question handouts readily available?

Are appropriate booklets available for the discussion leader?

If all systems are go, you are set to begin. Any further instructions will be found in the introductory portion of the audio presentation.

BEST COPY AVAILABLE

AIR QUALITY PRESENTATION

Discussion Questions

1. What seems to be society's problems with air quality?
2. What do we do that contributes to problems in air quality?
3. Why do we do things that contribute to problems of air quality?
4. How serious are our problems with air quality?
5. How much of our problems with air quality do you think we will be able to tolerate now and in the future?
6. What might be some of the effects of our tolerance of certain degrees of air quality problems on future generations?
7. What are we doing to alleviate problems with air quality?
8. What behaviors are people developing to help alleviate the problems?
9. What legislation is proposed or being applied to help solve the problems?
10. What research and development are being conducted?
11. What educational programs and approaches are being used?
12. What roles can a person or a group play in alleviating the current problems, in effecting solutions to current problems, and preventing future problems?

ECOLOGICAL CONCEPTS PRESENTATION

Discussion Questions

1. A key part of the word "ecosystem" is system. In ecosystems things interact. They act on each other in many ways, but in ways they enable the ecosystem to operate as a true system. Can you describe some of the interactions that make ecosystems function as systems?

2. Can you describe some of the natural events or processes that determine what specific kinds of living things, (what plants and what animals and what decomposers) are able to live in various different ecosystems?

3. What is the basic difference between the ways that materials (such as oxygen, carbon dioxide, minerals and water) move in ecosystems and the way that energy moves in ecosystems?

4. In our own living, we people find diversity of experiences important to our lives. In well functioning ecosystems, variety or diversity isn't just a pleasurable experience, it's essential to the functioning of the ecosystem. Why is variety in numbers and kinds of living things necessary to ecosystems?

5. What are some examples of the way that we have simplified ecosystems and ecosystem interactions on our agricultural and forest lands and in our own yards and gardens?

6. What kinds of diversity or variety have been planned into the environment of our cities, or might be included in our cities that would make cities a more pleasurable system in which to live?

7. I've briefly discussed cultural eutrophication. What have been some other effects of man's changing material movements in ecosystems on man's environment?

8. What sorts of natural phenomena influence population sizes in ecosystems?

9. What are some ways in which we can use our knowledge of ecosystems and our skills of systems analysis to look at environmental problems that affect man and other living things?

ENERGY PRESENTATION

Discussion Questions

1. What seems to be society's problems with energy?
2. What do we do that contributes to problems in energy?
3. Why do we do things that contribute to problems of energy?
4. How serious are our problems with energy?
5. How much of our problems with energy do you think we will be able to tolerate now and in the future?
6. What might be some of the effects of our tolerance of certain degrees of energy problems on future generations?
7. What are we doing to alleviate problems with energy?
8. What behaviors are people developing to help alleviate the problems?
9. What legislation is proposed or being applied to help solve the problems?
10. What research and development are being conducted?
11. What educational programs and approaches are being used?
12. What roles can a person or a group play in alleviating the current problems, in effecting solutions to current problems, and preventing future problems?

LIFE QUALITY PRESENTATION

Discussion Questions

1. What do you feel are your personal life needs--life requirements--to live a "quality life"?

2. Do you feel that these needs will change substantially as you get older?

3. Do you feel that your life needs are common to most United States citizens?

4. What events in your life time have made it more difficult for you and others to attain a "high life quality"?

5. What have been the influence of your and others' needs on human and natural environments?

6. What influences might your and others' needs and wants have on future environments?

7. Where do you get most of your ideas about the state of human and natural environments?

8. Why do people having differing opinions on a subject find it difficult to discuss their differing opinions calmly?

9. What might you and I do to improve our abilities to communicate with people who hold differing views and/or differing attitudes.

10. What are some effective ways we can have our opinions aired and listened to by decision makers?

SOLID WASTE MANAGEMENT PRESENTATION

Discussion Questions

1. What seems to be society's problems with solid wastes?
2. What do we do that contributes to problems in solid waste management?
3. Why do we do things that contribute to problems of solid wastes and solid waste management?
4. How serious are our problems with solid wastes and solid waste management?
5. How much of our problems with solid wastes do you think we will be able to tolerate now and in the future?
6. What might be some of the effects of our tolerance of certain degrees of solid waste management problems on future generations?
7. What are we doing to alleviate problems with solid wastes?
8. What behaviors are people developing to help alleviate the problems?
9. What legislation is proposed or being applied to help solve the problems?
10. What research and development are being conducted?
11. What educational programs and approaches are being used?
12. What roles can a person or a group play in alleviating the current problems, in effecting solutions to current problems, and preventing future problems?

BEST COPY AVAILABLE

TRANSPORTATION AND LAND USE PRESENTATION

Discussion Questions

1. What seems to be society's problems with transportation and land use?

2. What do we do that contributes to problems in transportation and land use?

3. Why do we do things that contribute to problems of transportation and land use?

4. How serious are our problems with transportation and land use?

5. How much of our problems with transportation and land use do you think we will be able to tolerate now and in the future?

6. What might be some of the effects of our tolerance of certain degrees of transportation and land use problems on future generations?

7. What are we doing to alleviate problems with transportation and land use?

8. What behaviors are people developing to help alleviate the problems?

9. What legislation is proposed or being applied to help solve the problems?

10. What research and development are being conducted?

11. What educational programs and approaches are being used?

12. What roles can a person or a group play in alleviating the current problems, in effecting solutions to current problems, and preventing future problems?

WATER QUALITY PRESENTATION

Discussion Questions

1. What seems to be society's problems with water quality?
2. What do we do that contributes to problems in water quality?
3. Why do we do things that contribute to problems of water quality?
4. How serious are our problems with water quality?
5. How much of our problems with water quality do you think we will be able to tolerate now and in the future?
6. What might be some of the effects of our tolerance of certain degrees of water quality problems on future generations?
7. What are we doing to alleviate problems with water quality?
8. What behaviors are people developing to help alleviate the problems?
9. What legislation is proposed or being applied to help solve the problems?
10. What research and development are being conducted?
11. What educational programs and approaches are being used?
12. What roles can a person or a group play in alleviating the current problems, in effecting solutions to current problems, and preventing future problems?

BEST COPY AVAILABLE

Environmental Education Project
"A Problem Approach"
Supplementary Booklets

Title	Stock #*	Unit Price*
Action for Environmental Quality - Standards and Enforcement for Air and Water Pollution Control	5500-00087	$ .75
The Challenge of the Environment - A Primer on EPA's Statutory Authority	5500-00078	.40
Citizen Action Can Get Results	5500-00070	.20
A Citizen's Guide to Clean Air		
Citizen Role in Implementation of Clean Air Standards		
Citizen Suits Under the Clean Air Act		
Common Environmental Terms - A Glossary	EP1.2:T27	.35
Don't Leave It All to the Experts - The Citizen's Role in Environmental Decision Making	EP122-D71	.55
An Environmental Bibliography	5500-0058	.15
Groups That Can Help - A Directory of Environmental Organizations	5501-00418	.15
The Harmful Intruder - Noise in the Home	EP122-N69/19	.15
Highlights - The Federal Environmental Pesticide Control Act of 1972		
Highlights - The Federal Water Pollution Control Act of 1972	5502-000-98	.15
Highlights - The Marine Protection, Research and Sanctuaries Act of 1972 (Ocean Dumping)		
Highlights - The Noise Control Act of 1972		
Indian Creek Reservoir: A New Fishing and Recreational Lake From Reclaimed Wastewater		
The Metro Story - How Citizens Cleaned Up Lake Washington	EP122-W/27	.10
Mission 5000 - A Citizens' Solid Waste Management Project	5502-0087	.50
Noise From Heavy Construction	EP122-N69/20	.15
Noise Pollution - Now Hear This	5500-0072	.35
Oregonians Restore the Willamette - Joint Citizen, State, and Federal Efforts Clean River Waters	5501-00467	.15
Pesticides		.10
A Primer On Waste Water Treatment		.55
Public Law 92-500 92nd Congress, S. 2770 October 18, 1972		
Research and Monitoring: Cornerstone for Environmental Action	5500-0073	.60
Selected Publications on the Environment		
Toward A New Environmental Ethic	5500-0031	.60

* Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

READINGS

GENERAL:

Blau, Sheridan & Rodenbeck, John, The House We Live In, The Macmillan Company, New York, N.Y., 1971.

Ehrlich, P.R. & Ehrlich, A.H., Population, Resources, Environment, W.H. Freeman and Company, San Francisco, California, 2nd Edition, 1972.

Griffith, Charles J., et. al., EP - The New Conservation, The Izaak Walton League of America, Arlington, Va., 1971, $1.25.

Hickel, Walter J., Who Owns America?, Paperback Library, a division of Coronet Communications Inc., New York, N.Y., 1972, $1.50.

LaFollette, Doug, Wisconsin Survival Handbook, Wisconsin Environmental Decade, Racine, Wisconsin, 1971, $.95.

Rockefeller, John D. and others of the Commission on Population Growth and the American Future, Population and the American Future, A Signet Special from the New American Library, Inc., New York, N.Y., 1972, $1.50.

AIR QUALITY:

Battan, Louis, Unclean Sky, Doubleday.

Carr, Donald, The Breath of Life, Norton.

The Ralph Nader Study Group Report on Air Pollution, Vanishing Air, Grossman Publishers.

National T.B. and Respiratory Disease Association, Air Pollution Primer, 1971, no charge.

The Conservation Foundation, A Citizen's Guide to Clean Air, 1972, no charge.

ECOLOGICAL CONCEPTS:

Allen, Durward, Our Wildlife Legacy, Funk & Wagnels Company, Inc., New York, N.Y., 1962.

Farb, Peter and the Editors of LIFE, Ecology, Life Nature Library, Time, Inc., New York, N.Y., 1963.

Pringle, Laurence, Ecology Science of Survival, The Macmillan Company, New York, N.Y., 1971, $4.95.

Smith, Robert L., Ecology and Field Biology, Harper and Row, New York, N.Y., 1966.

Storer, John, The Web of Life, Devin-Adair Company, New York, N.Y., 1959.

READINGS

ENERGY:

National Geographic Magazine, November 1972 issue.

Theobald, P.K. and others, Energy Resources of the United States, U.S. Geological Survey Circular No. 650, U.S. Department of the Interior, Geological Survey, Arlington, Virginia, 1972.

Time Magazine, October 8, 1973 issue.

LIFE QUALITY:

Leopold, Aldo, A Sand County Almanac, Oxford University Press, 1949.

Nasar, W.H. and Folkerts, G.W., Environmental Problems: Principles, Readings and Comments, W. C. Brown Company, Publishers, Dubuque, Iowa, 1973.

Toffler, Alvin, Future Shock, Bantam Books, Inc., New York, N.Y., 1970, $1.95.

Thoreau, Henry David, Walden, New American Library, 1942.

SOLID WASTE:

McKenzie, Garry D. & Utaard, Russell O., Man and His Physical Environment, Burgess Publishing Company, Minneapolis, Minn., 1972.

Pauline, Lawrence J. and Weishaus, Howard, Ecology: Man's Relationship to His Environment, Oxford Book Company, New York, N.Y., 1971.

Roloff, Joan G. & Wylder, Robert, There Is No "Away," Glenco Press, A Division of Macmillan Company, Beverly Hills, Calif., 1971.

U.S. Environmental Protection Agency, Solid Waste Management Glossary, (SW-108ts) Superintendent of Public Documents, U.S. Government Printing Office, Washington, D.C., 1972.

TRANSPORTATION AND LAND USE:

Detwyler, T.R. & Marcus, M.G., Urbanization and Environment, Duxbury Press, A Division of Wadsworth Publishing Company, Inc., Belmont, Calif., 1972.

Higbee, Edward, The Squeeze: Cities Without Space, William Morrow and Company, New York, N.Y., 1960.

Howard, Ebezer, Garden Cities of Thominow, Swan Sonnensehein and Company Ltd., London, 1902.

Report of a Symposium sponsored by the Bureau of Sports Fisheries and Wildlife, Man and Nature in the City, U.S. Department of the Interior, Washington, D.C., 1969.

Continued

TRANSPORTATION AND LAND USE (Continued)

Seymour, Whitney North Jr. (Editor), Small Urban Spaces, New York University Press, New York, N.Y., 1969.

Whyte, William H., The Last Landscape, Doubleday and Company, Garden City, New York, 1968.

WATER QUALITY

Armoy, William H., The Life of the Pond, McGraw-Hill Book Co., New York, N.Y., 1967.

Andrews, William A., A Guide to the Study of Freshwater Ecology, Prentice-Hall, Inc., New Jersey, 1972.

Niering, William A., The Life of the Marsh, McGraw-Hill Book Co., New York, N.Y., 1967.

Usinger, Robert L., The Life of Rivers and Streams, McGraw-Hill Book Co., New York, N.Y.

BEST COPY AVAILABLE